The New Zealand

Journal of Agriculture.

Vol. XXX.—No. 1.

WELLINGTON, 20TH JANUARY, 1925.

A RECONNAISSANCE SURVEY OF PUMICE SOILS.

ROTORUA COUNTY.

(Continued.)

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

III. KAHAROA AND TE PU.

IN the November and December numbers of the *Journal* it has been shown that the great extent of both Mamaku and Rotorua Basin lands are either sandy loams or sandy silts. The latter occupy by far the greater area.

As one travels north from Lake Rotorua the soil becomes even coarser. This increase in coarseness is due to the larger amount of fine gravel present. A new [illegible] red to designate this type of soil, which sh [illegible] "Kaharoa fine gravelly sand." It will be s [illegible] sults of analyses that the "fine gravel" fractio [illegible] egligible quantity in the pumice soils previou [illegible] present in quantity ranging from one-fifth t [illegible] of the soil; and when to this is added the stones and gravel which are separated from the soil in preparing it for analysis the coarseness is further increased from another most appreciable cause. Concurrently with the increase in the coarser particles the proportion of the finer particles is necessarily decreased. This extreme coarseness of the soil is noticeable on leaving Hamurana and climbing the slopes of the natural rampart leading to the terrace on the northern slope near the top, above, but facing away from, Rotorua Lake, in scrub land, at 625 ft.,

and in the tawa-rimu-mangeao forest beyond and *below* this terrace land. Has this terrace land ever borne any primitive vegetation larger than scrub which has been removed by the aboriginal owners, or is it that the water content of the soil has not been sufficient for the development of forest? In the forest below, the soil is moister and the trees unusually tall. There is no difference in the mechanical or chemical composition of the soil, save possibly the water content, and this may be the factor which has determined the quality of the natural vegetation, the water draining out readily from the high terrace—a large catchment area—on to the lower slopes now densely forested.

A similar condition of things exists on the area known as the Kapakapa Road, 400 ft. above Rotorua. This road runs along a high slope north of the latter site. The soil is similar to sample R 976, and bush sickness is more prevalent here, the stock having to be changed perhaps oftener than in any other part. At the end of the road, which falls to about 150 ft. above Rotorua, there is some fine land which is much moister and on which the sickness is never experienced. This carries very tall forest similar to that on R 976. Springs are in evidence in many places in the lower area, but are entirely absent on the higher portions of the slope. A similar instance is found on the Kaharoa Road, a forested area; where there are no springs the trouble appears, but where there is plenty of spring or creek water the stock are said to be perfectly healthy. Thus at the extremity and lower portion of these two blind roads the cattle-sickness is unknown. The writer considers this as being a parallel to the well-known case of the lake-side paddocks (see p. 370, December, 1924, *Journal*) and the bush-sick areas up on the hills. Where the soil is kept well saturated with water by seepage from springs or surface water there is no sickness, and where the soil is dependent on rainfall the soil-water so soon drains away that there is not sufficient to act as a carrier of mineral plant-food from the soil to the plant-roots. An analogous case occurred once in the Norsewood district (Hawke's Bay). Here cows suffered in a droughty season from bone malnutrition, although there was chemical evidence that phosphates were not deficient in the soil. The water was probably the limiting factor, the natural pasture being insufficiently nutritious to keep the stock healthy.

In the chemical analyses of these fine gravelly sands there is little to distinguish them from the Rotorua Basin soils save a slightly higher lime content and a slightly lower available iron content. Available and total phosphoric acid, as in all pumice soils, is deficient.

On traversing the Kapakapa, Kaharoa, and the main Rotorua–Tauranga roads in the vicinity of Te Pu the extreme coarseness of the soil is readily discernible to the traveller in the road cuttings. One may, with the aid of mechanical analyses, unhesitatingly affirm that a large extent of country at the north end of the lake is marked by such a coarseness of texture that the student of soil science would be put on his guard and naturally look for untoward results in farming such country; but where the physiography of the country is such that the surface soil is supplied with the optimum requirement of water he would come to lands which unite in the highest degree two essential conditions of fertility—porosity and a constant supply of water.

There is a strong local opinion that the stock by drinking spring-water are thereby cured of bush sickness, or if pastured in the vicinity of springs or creeks never become bush sick; whereas if the drinking-water for stock is supplied from rain-water caught and stored in concrete tanks or cisterns the animals suffer from iron-hunger. Analyses of the waters from springs and tanks, however, afford no evidence to support the truth of this local belief. The explanation of the immunity from iron-starvation which stock enjoy in country which is well watered with springs is probably that in such areas the soil is well supplied with moisture from the high land. The greater moisture content of the soil enables the pasture to absorb larger amounts of plant-food, especially iron, from the soil around it. Such immune areas are not more than 100 ft. to 350 ft. above lake-level, but the worst country is some 400 ft. to 600 ft. above the lake and contains no running water or signs of springs.

An instance was given to the writer by the manager for a very well known landowner who has interests in this area of a mob of 1,000 sheep from Hawke's Bay which were kept here from the end of January until August. Those pastured on country with springs went ahead, but those pastured on adjacent land containing no springs and supplied only with tank-water did not improve in condition. When, however, they were transferred to land with springs they improved like the others.

The obvious treatment which these facts demonstrate as fitting for the farmer to practise on such country is to fence off the area showing unusual moisture in the soil, and to endeavour to enhance to a greater degree the superior fertility which it shows over the drier country by applying the best top-dressing that can be procured. The one that has been found most effective at the Mamaku Demonstration Farm is a mixture of superphosphate and basic slag of high grade. This mixture is a fertilizer containing all the mineral plant-foods which bush-sick country needs—iron, phosphates, calcium in non-caustic form, and sulphur—as well as such elements as manganese. Potash, it should be noted, is present in all pumice soils in comparative abundance.

The climate of the Kaharoa area is possibly much milder than that of Mamaku and even that of Rotorua, for the forest contains two trees, the mangeao and kohekohe, which indicate milder conditions. The forest, which is of the tawa-rimu type, is exceptionally tall, that at the end of the Kaharoa Road consisting as follows:—

Forest trees: *Beilschmiedia tawa, Dacrydium cupressinum* (rimu), *Knightia excelsa* (rewarewa), *Laurelia novae-zelandiae* (pukatea), *Litsaea calicaris* (mangeao), *Podocarpus ferrugineus* (miro).

Shrubs and small trees: *Aristotelia racemosa* (wineberry), *Carpodetus serratus, Dysoxylum spectabile* (kohekohe), *Fuchsia excorticata, Geniostoma ligustifolium, Hedycarya arborea* (porokaiwhiria), *Melicytus ramiflorus* (mahoe), *Metrosideros florida, M. robusta* (rata), *M. scandens, Piper excelsum* (kawakawa), *Rhipogonum scandens* (supplejack), *Rubus australis* (lawyer), *Weinmannia racemosa* (tawhero).

Forest-floor plants: *Alseuosmia macrophylla, Aspidium hispidum, Asplenium bulbiferum, Astelia Solandri, Cyathea dealbata, Hymenophyllum* sp., *Lomaria discolor, L. capense, L. filiformis, Lygodium articulatum, Muehlenbeckia australis, Polypodium pennigerum, P. punctatum, P. serpens, Pteris scaberula, Uncinia* sp.

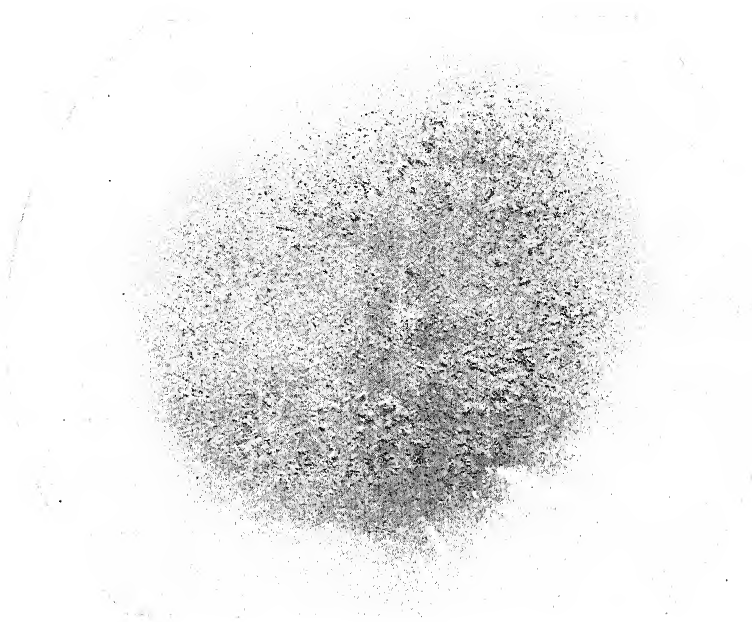


FIG. 7. LOAM SOIL, WELLINGTON (LABORATORY NO. R 814).

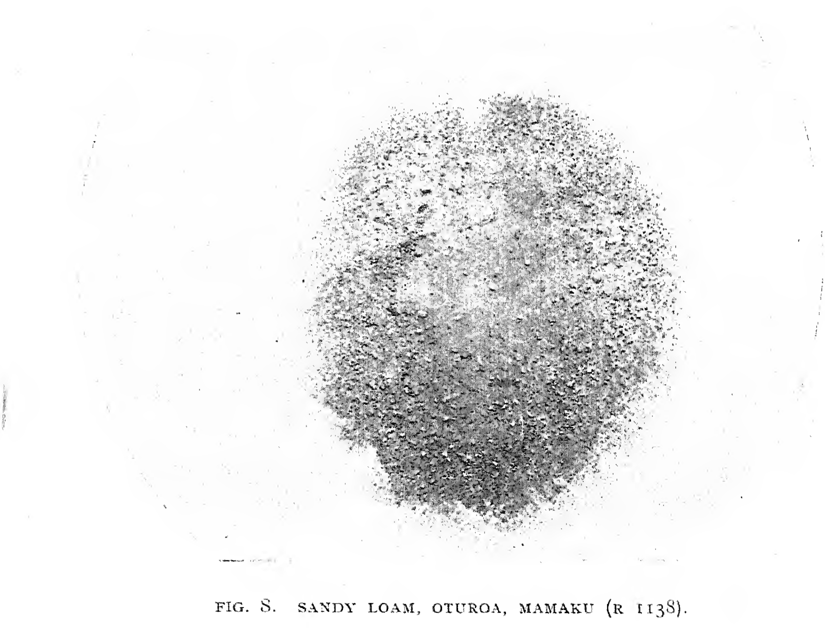


FIG. 8. SANDY LOAM, OTUROA, MAMAKU (R 1138).

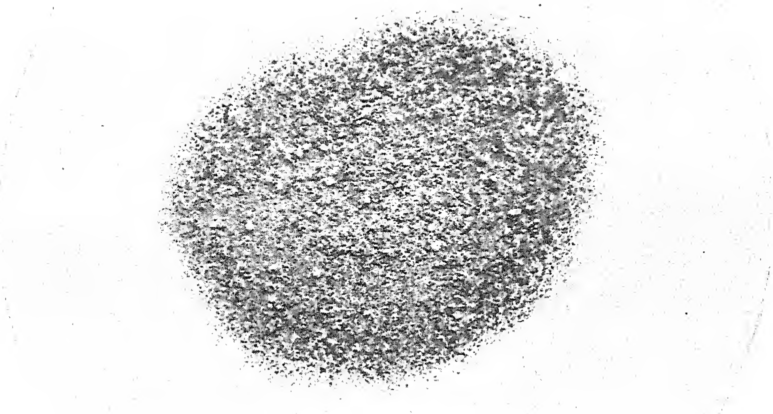


FIG. 9. SANDY SILT, MAMAKU (S 182).

FIG. 10. FINE GRAVELLY SAND, KAHAROA (R 1117).

[*Photos by Chemical Laboratory.*

The illustrations show the texture of the three main types of pumice soils described in the last three numbers of the *Journal*—together with a Wellington soil for comparison—when treated in the following manner and allowed to dry and then photographed: 2 c.c. of fine earth are mixed with 3 c.c. of water in a 10 c.c. glass cylinder, and after light rubbing with a rubber-tipped stirring-rod are shaken for four minutes. A 15 cm. filter-paper is moistened with 3 c.c. of water and spread flat on a horizontal plate of glass. The cylinder of soil and water, closed by the thumb, is inverted 1 cm. above the centre of the paper, and the contents are rapidly released. The extent to which the soil becomes spread over the paper is seen to vary with the fineness—*i.e.*, as the soil becomes increasingly finer the larger is the area covered; conversely, the coarser the soil the smaller is the space occupied. The Wellington loam (R 814) shows what a good fertile soil looks like. The Oturoa sandy loam (K 1138) closely resembles the first, but is slightly coarser; the Mamaku sandy silt (R 182) is obviously a very coarse-grained soil; while the Kaharoa fine gravelly sand (R 1117) is the extreme type of coarse pumice soils. The disk partly shown in each illustration represents the 15 cm. filter-paper (about 6 in. diameter), and thus gives the reduced scale.

TABLE 5. MECHANICAL ANALYSES.

(Results, except R 970, are percentages on air-dried soil.)

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.								Stones and Gravel.	Remarks
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.		
					Coarsest Pumice Lands.						
R 1105	Fine gravelly sand ..	26·0	38·3	11·1	8·6	3·9	1·2	1·6	8·4	8·6	Pasture, Kaharoa Road; 200 ft. above Lake Rotorua.
1108	" ..	20·6	46·1	9·0	6·9	5·0	1·1	1·5	10·3	7·2	Pasture, Glenmore, Kaharoa Road 130 ft. above Lake Rotorua.
1114	Coarse sand	13·7	52·6	11·2	8·6	4·7	1·3	1·0	6·7	5·1	Pasture, Kaharoa Road.
1117	Fine gravelly sand ..	20·3	44·0	11·8	9·9	3·6	1·2	1·3	7·5	3·1	Pasture, Kapakapa Road; terrace, 400 ft.
1121	" ..	17·9	52·1	9·3	7·8	4·4	0·6	1·1	6·4	5·1	Pasture, Kapakapa Road; 150 ft.
1134	Coarse sand	11·9	48·4	13·7	9·7	5·4	1·4	1·9	7·7	13·0	Lake Rotoiti, fern slopes; 105 ft.
1136	"	2·9	55·4	15·5	10·7	6·4	1·9	0·9	6·5	3·1	Pasture, flat-topped ridge, Lake Rotoiti; 100 ft.
1143	Fine gravelly sand ..	23·7	39·0	10·7	8·2	7·7	0·8	1·2	8·6	5·0	Forest, Mangarewa–Kaharoa Gorge; little birch.
1145	" ..	19·6	33·0	13·2	12·3	7·1	2·2	2·4	10·6	15·0	Fern land, Kaharoa – Te Pu Road.
973	" ..	26·9	33·7	13·5	8·9	4·7	0·8	2·4	8·0	15·4	Scrub land; 625 ft. above Lake Rotorua.
976	" ..	19·8	38·8	14·9	8·4	5·3	0·8	1·0	9·1	13·6	Forest, rimu-tawa-mangeao.
970	" ..	21·2	32·7	15·9	9·9	4·9	0·1	1·7	11·9	19·0	Fern and scrub regrowth, Hamurana; 300 ft. above lake.
S 61	Coarse sand	12·6	32·0	12·5	9·3	4·6	1·7	23·3	5·7	..	Pasture, Rotorua Lake side; probably floated beach.
H 480	Fine gravelly sand ..	16·8	45·6	17·9	8·3	2·3	1·2	3·5	4·1	20·0	Pasture, Rotorua Lake side; probably floated beach.
482	" ..	17·6	41·7	12·8	15·0	3·5	1·2	1·3	6·8	24·1	Waerenga East.

Mechanical analyses by R. E. Grimmett.

TABLE 6. CHEMICAL ANALYSES.

(Results, except *, are percentages on soil dried at 100° C.)

Laboratory No.	Locality.	Volatile Matter.			Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).				Hydrogen-ion Determination.	Fe (Iron) Extracted by 1-per-cent. Citric Acid.
		* On Air-drying.	* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	pH Value.	
	Coarsest Pumice Lands.														
R 1105	Rotoiti S.D., Block 5, Section 2 ..	13	1·74	7·97	0·225	0·289	0·042	0·031	0·010	0·35	0·16	0·09	0·02	..	0·032
1108	Glenmore, 130 ft.	29	1·82	10·28	0·294	0·156	0·060	0·020	0·006	0·71	0·31	0·13	0·02	..	0·032
1114	Rotoiti S.D., Block 2, Section 7 ..	15	1·00	6·42	0·192	0·109	0·041	0·016	0·004	0·40	0·22	0·11	0·02	..	0·037
1117	Kapakapa Road, 410 ft.	18	1·68	7·63	0·208	0·161	0·026	0·016	0·006	0·31	0·16	0·15	0·04	..	0·036
1121	Kapakapa Road, 150 ft., grass ..	13	1·06	6·71	0·235	0·448	0·036	0·015	0·011	0·66	0·23	0·09	0·04	..	0·037
1134	Rotoiti, 105 ft.	18	1·96	7·94	0·211	0·139	0·031	0·016	0·006	0·86	0·29	0·12	0·03	..	0·023
1136	Rotoiti, 100 ft., flat-topped ridge ..	14	1·18	6·39	0·208	0·307	0·016	0·024	0·008	1·43	0·53	0·16	0·03	..	0·040
1143	Mangarewa Gorge, 445 ft.	23	1·60	9·03	0·222	0·172	0·026	0·020	0·004	0·46	0·10	0·05	0·02	5·5	0·017
1145	Kaharoa, 365 ft.	23	2·60	11·00	0·221	0·089	0·026	0·026	0·004	0·22	0·17	0·08	0·03	..	0·036
973	Rotoiti, scrub	13	2·44	8·17	0·230	0·109	0·020	0·018	0·004	0·32	0·22	0·09	0·04	..	0·018
976	Rotoiti, forest	29	1·00	8·44	0·255	0·143	0·033	0·019	0·002	0·47	0·20	0·08	0·03	..	0·028
970	Hamurana, 300 ft.	28	1·70	12·06	0·224	0·125	0·058	0·023	0·005	0·45	0·23	0·08	0·06	..	0·020
S 61	Lake-side, Rotorua	..	23·32	7·40	0·197	0·150	0·022	0·011	0·006	0·32	0·12	0·07	0·04	..	0·023

The heights stated are feet above Lake Rotorua, which itself is 915 ft. above sea-level.

Chemical analyses by L. D. Foster.

A good deal of the country about here has been tutu and fern land, and possibly represents old Maori clearings.

In spite of the great coarseness of these Kaharoa and Te Pu soils there are mitigating circumstances which improve the prospects of the settler on these lands and reconcile him to his lot. One would think that the climate is warmer and the land more sheltered from winds than are most pumice lands, but the great factor in combating adverse soil conditions must be the proximity of land free from bush sickness and suitable for change paddocks. One other factor is the freedom from the counter-attraction of more remunerative forms of industry. There is no sawmilling trade or tourist traffic to absorb the energies of the settlers, and consequently the community is purely a farming one; the interests of all are identical. The visitor is impressed with the fine type of settlers and the way they are combining for the common good; so that even on the worst class of country—the soil of which is so coarse and dry that the stock have to be changed twice a year—there is a healthy optimistic tone about the district which is most cheering and helpful to the investigator of a difficult problem.

CLEANING OF MILKING-MACHINES.

J. W. SMITH, Dairy Instructor, Palmerston North.

In the course of his visits to farms for assisting and instructing farmers in dairy-work the writer has found many and varied methods of cleaning milking-machines in vogue, and is satisfied that there is a laudable desire on the part of users to keep their machines in a clean condition, and to carry out the work in a way which will ensure the longest possible working-life of all parts, particularly the rubberware.

In many cases more time is spent on the work of cleaning than is really necessary, the life of the rubbers is shorter than need be, and, in addition, too much faith is placed in the supposed merits of more or less costly commercial preparations for cleaning dairy appliances. Some cleansing-material is necessary to remove greasy deposits left by the milk, and no material will effect this more thoroughly or at a lower cost than a solution of soda. Either washing-soda or caustic soda may be used. Care and judgment must be exercised in using soda solution, for should any get into the milk the effect is disastrous, especially when the milk is for making into cheese. Furthermore, damage may result to the machine or other apparatus to which a soda solution is applied if the latter is not promptly and completely removed after use.

THE CAUSTIC-SODA-AND-BOILING-WATER METHOD.

Of the many methods which have come within the writer's experience he would direct special attention to the caustic-soda-and-boiling-water method, which a number of practical farmers have been using for about two seasons with excellent results in respect to the sanitary condition of the milk, the cleanliness of the machine, an extended life for the rubberware, and a considerable saving of time.

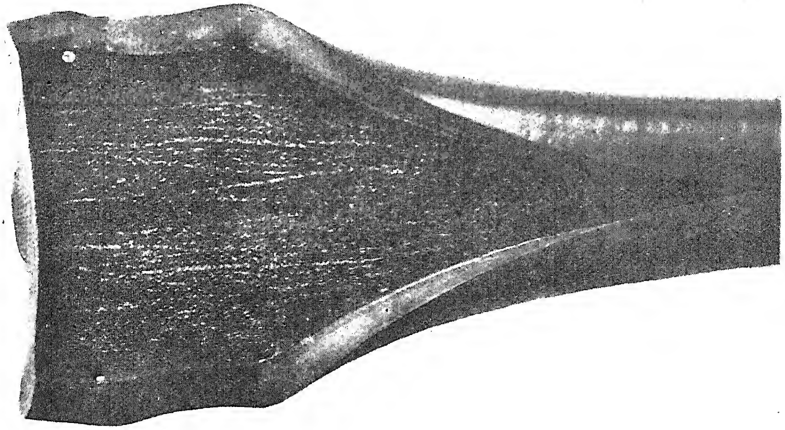


FIG. 1. LONG MILK-RUBBER AFTER TWELVE MONTHS' USE AND CLEANING DAILY WITH BOILING WATER, WASHING-SODA, AND THE USE OF A BRUSH AND SCRAPER. NOTE THE SCORED INNER SURFACE OF THE TUBE.

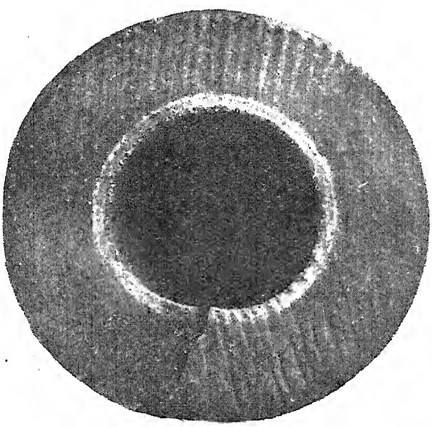


FIG. 2. END VIEW OF THE SAME RUBBER (FIG. 1). THE WHITISH INNER CIRCLE INDICATES THE SCORED SURFACE OF THE TUBE.

The writer has been demonstrating and recommending this method for several months, and is confident as to its efficiency, provided it is carefully carried out.

The quantity of boiling water required is small, but the water must be at boiling temperature—not merely hot or warm. The hot water from the jacket of an oil or benzine engine is not sufficiently high in temperature, and therefore its use is not recommended. The caustic-soda solution must be well stirred and thoroughly dissolved in the boiling water. The solution will not spoil tinned ware, provided it is rinsed off immediately after use. Care must be taken to prevent the solution lodging in the milk-holding vat. No scrapers or spiral

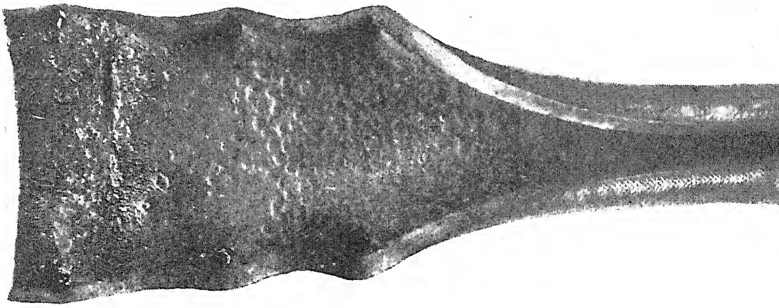


FIG. 3. CLAW-TUBE RUBBER FROM THE SAME MACHINE AS MILK-TUBE IN FIGS. 1 AND 2. THE INDENTATIONS INDICATE EFFECT OF LODGMENT OF GREASE.

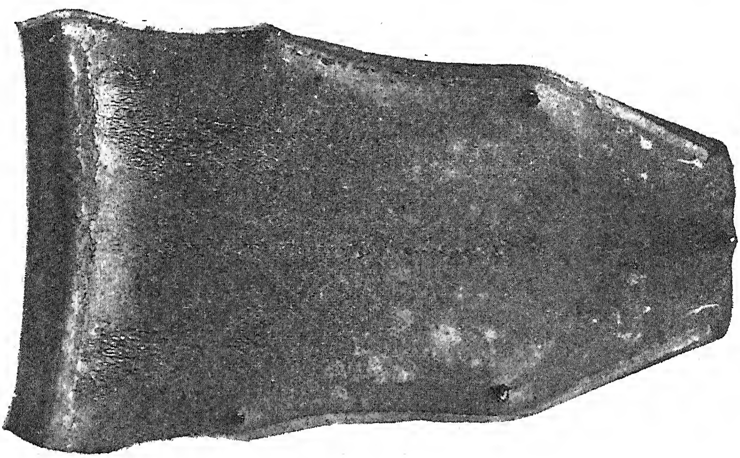


FIG. 4. ORDINARY TEAT-CUP SOFT INFLATION AFTER THREE MONTHS' USE, SHOWING THE EFFECTS OF BRUSHING.

hair-brushes are necessary for cleaning the inner surface of the rubbers, and scoring is thereby avoided. The outside as well as the inside of the rubbers must be kept clean, otherwise their life is shortened. Rubbers after being cleaned should be laid out without bends or twists. To operate the method successfully it must be done immediately after milking. The time taken to complete the work need not exceed twenty minutes.

The essentials required at the milking-shed are—(1) a suitable plant for boiling water; (2) a stock of caustic soda; (3) an ample supply of clean water; (4) some scrubbing-brushes, large buckets, a suitable bath or tub, and a ball of horsehair.

To operate the method the procedure is as follows:—

(1.) Before milking draw cold water through all milk-tubes and the releaser, so as to prevent the adhesion of milk to the pipes, &c.

(2.) Immediately after milking wash all dirt off the outside of the teat-cups and rubbers; then draw through each set of teat-cups

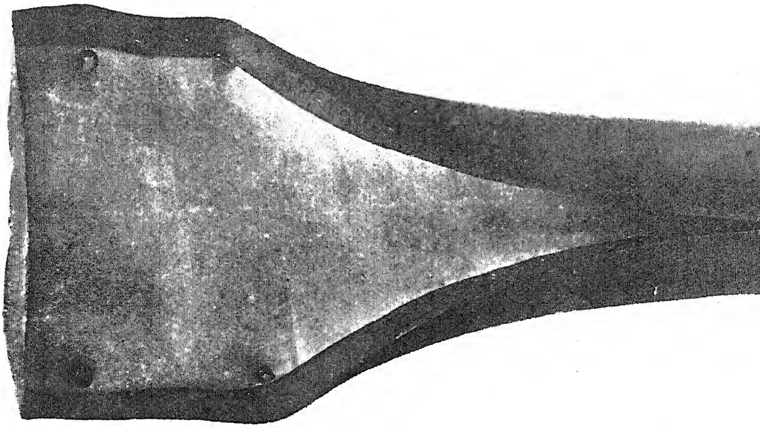


FIG. 5. LONG MILK-RUBBER AFTER TWO SEASONS' USE AND CLEANING DAILY BY THE CAUSTIC-SODA-AND-BOILING-WATER METHOD.

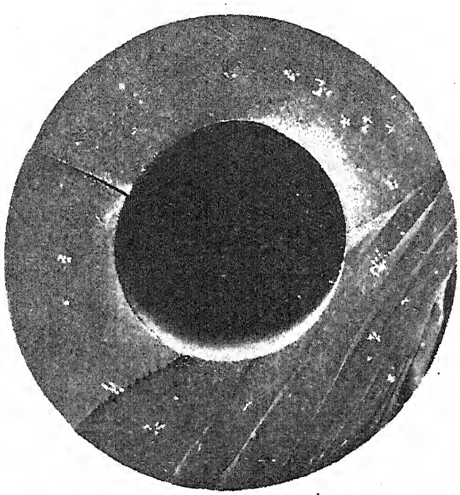


FIG. 6. END VIEW OF THE SAME RUBBER (FIG. 5).

sufficient cold (or preferably warm) water to flush out the milk-system. When drawing the water through the set farthest from the releaser insert a ball of horsehair in the end of the milk-pipe, to cause it to travel through to the releaser with the water.

(3.) Next draw through *each set* of teat-cups *not less than 1 gallon of boiling water* to which caustic soda has been added at the rate of *not less than one to 1½ tablespoonfuls per 4 gallons of boiling water.* Distribute the solution as evenly as possible through each set of teat-cups.

(4.) Immediately follow by flushing out the caustic-soda solution with 2 gallons of hot water or 1 gallon of boiling water for each

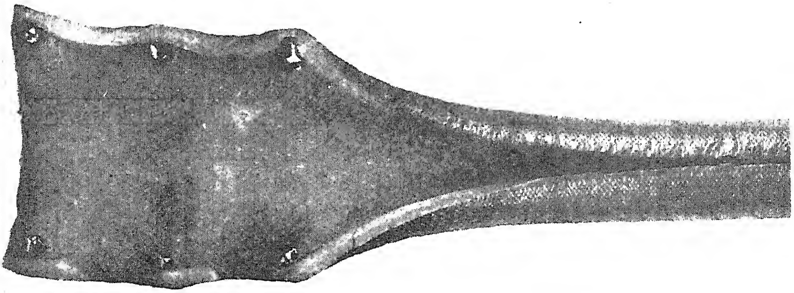


FIG. 7. CLAW-TUBE RUBBER FROM THE SAME MACHINE AS MILK-TUBE IN FIG. 5.

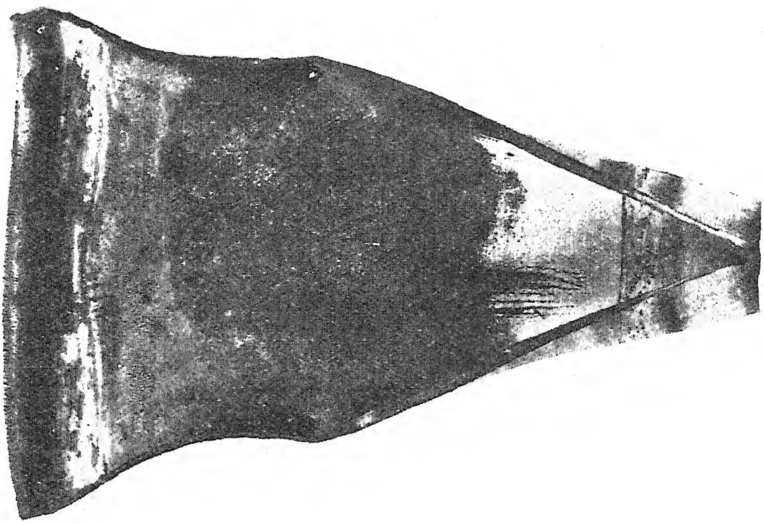


FIG. 8. ORDINARY TEAT-CUP SOFT INFLATION AFTER FOUR MONTHS' USE AND CLEANING BY THE CAUSTIC-SODA-AND-BOILING-WATER METHOD.

set of teat-cups. The flushing with boiling water helps to dry the rubbers and leaves the milk-system dry and sweet.

(5.) Then remove or open the plug or flap from the releaser-pipe, to allow of free circulation of air.

(6.) Next clean the vacuum-system in the same manner as the milk-system, by drawing through first the caustic-soda solution, and next the boiling water which has been circulated through the milk-system. Pay particular attention to the cleaning of the pipe connecting the releaser to the vacuum-tank, by flooding the releaser to cause the water to travel through to the vacuum-tank. *This is important.*

(7.) The engine can now be stopped. Disconnect the two long rubbers from downpipes and teat-cups, and hang in a clean airy place out of the sun.

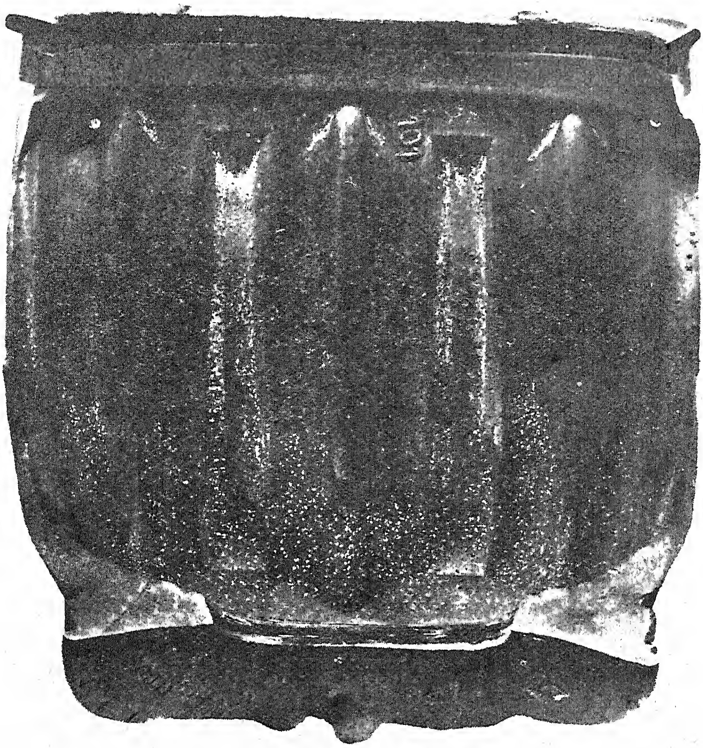


FIG. 9. A GROOVED HARD TEAT-CUP INFLATION AFTER TWELVE MONTHS' USE AND CLEANING BY THE SAME METHOD. CAPABLE OF THREE MONTHS' FURTHER USE.

[*All photos by H. Drake.*

(8.) Next disconnect the releaser, wash, rinse, and place in a clean, dry, sunny place; then disconnect the top or bottom half of the vacuum-tank and treat in a similar manner.

To ensure effective cleaning by this method it is essential that it be carried out daily in the manner directed. The caustic-soda solution instantly removes the greasy coating left by the milk on the inner surface of the tubing, and the final flushing with boiling water ensures the removal of the caustic-soda solution. In a short time the inner surface of the rubbers, through the action of the caustic soda, will become coated with a hard glass-like surface. If, however, the method is not carried out daily in the manner directed the grease will penetrate into the rubber, and it will then be necessary to revert to the use of spiral brushes, which in turn will damage the inner surface, as indicated in the accompanying illustrations.

The photographs are of rubbers which have been in actual use and subjected to different methods of cleaning. These serve to demonstrate the good results obtainable by the use of the caustic-soda-and-boiling-water method of cleaning.

CORTICIUM-DISEASE OF POTATOES.

EXPERIMENTS IN CONTROL.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

CORTICIUM-DISEASE, caused by the fungus *Corticium vagum* Berk. *et* Curt., var. *Solani* Burt, is a widespread disease of the potato, for it has been recorded as occurring wherever the host is grown. During a recent plant-disease survey made by Mr. J. C. Neill, of this Laboratory, through the potato-growing regions of New Zealand it was invariably found to be present; and in the South Island it was found to be abundant in every line of potatoes inspected. Although so widespread, it is a disease that is commonly overlooked, due no doubt to the fact that its effects upon the host are not marked.

When the crop is being lifted the disease may be seen in the form of small black sclerotia scattered over the surface of the tuber (Fig. 1). These sclerotia are resting bodies of the causal organism, capable of remaining in a quiescent condition for an indefinite period. They are firmly attached to the tubers by means of hyphæ, and are not readily removed, consequently they accompany the tubers when the latter are planted. In the presence of moisture, such as is present in the soil, the sclerotia produce hyphæ which ramify through the soil in the vicinity of the tubers, and spread to the potato-shoots as they develop. These hyphæ would appear frequently to damage the growing points of the main shoots, with the result that secondary shoots are produced from below the injured portions. In this manner affected tubers may give rise to bunches of small and spindly shoots, which, being weakened, produce small and stunted plants; these in turn produce few and small tubers. Thus infection, when severe, may tend greatly to reduce the yield.

In the literature dealing with this disease the standard treatment recommended (1, 3, 4, 5, 6, 8),* which has been claimed to give complete control (100 per cent. killing of sclerotia), is the immersion of infected tubers in a solution of mercuric chloride (corrosive sublimate, $HgCl_2$) in water—1 part in 1,000 parts of water, or 1 part in 2,000—for one and a half or two hours. More recently it has been claimed (2)* that immersion for half an hour is sufficient to ensure death of all sclerotia.

A potato-grower in Otago this season treated the whole of his seed-tubers before sowing by immersion for one hour and a half in 1–1,000 mercuric chloride. After treatment he forwarded samples to this Laboratory to ascertain whether the treatment had been successful. Sclerotia from these tubers were plated out on suitable media, and 30 per cent. were found to be viable. This led to preliminary experiments being carried out in the Laboratory with a view to ascertaining whether the standard solutions recommended were at fault. These experiments were unsatisfactory in that a proportion of sclerotia treated were found to be viable. Therefore an elaborate series of experiments was undertaken with a view to definitely ascertaining the most

* References at end of this article.

efficient steep to be used, its strength, and the most suitable time of immersion (one hour and a half being considered much too long for farm practice).

In the following experiments tubers showing well-developed sclerotia were chosen. They were washed free from adhering earth and allowed to dry. The solutions were prepared in large glass vessels, and the tubers immersed for definite periods of time, then removed, labelled, and air-dried. Three tubers were considered sufficient for each phase of the experiment, and from each five sclerotia were removed and transferred to petri dishes containing certain culture-media — the most suitable being potato-dextrose-agar, which gave 100 per cent. of growth in controls. Each petri dish, by means of grease-pencil markings on the bottom, was divided into three sectors, and in each sector five sclerotia were placed. In this manner economy of media and petri dishes was obtained.

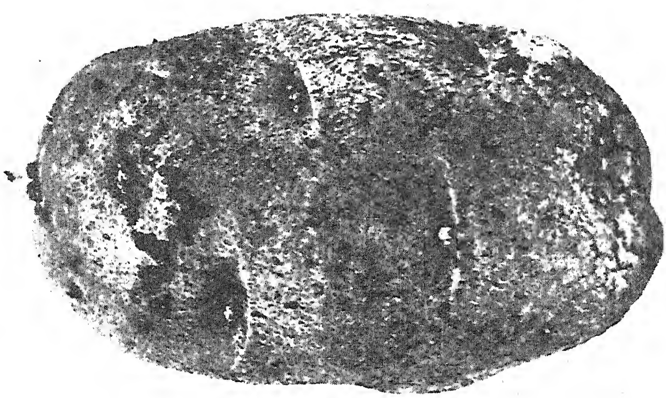


FIG. 1. POTATO TUBER COVERED WITH SCLEROTIA OF CORTICIUM-DISEASE. TWO-THIRDS NATURAL SIZE.

[*Photo by H. Drake.*

During the course of each experiment cultures were examined every twenty-four hours for five days, the final examination being made under the dissecting microscope. The cultures were then discarded, for it was found that if treated sclerotia made no growth before the third day they would not grow at all.

MERCURIC CHLORIDE ($HgCl_2$).

The first series of laboratory experiments was undertaken with a view to determining whether the mercuric solutions recommended would really kill sclerotia, and with the additional object of cutting down the time of immersion. The following strengths of solutions and times of immersion were used :—

Mercuric chloride—1–500, 1–750, 1–1,000, 1–1,250, 1–2,000, 1–2,500.
Times of immersion—15, 30, 45, 60, and 90 minutes.

a.

b.

FIG. 2. SCLEROTIA OF CORTICIUM-DISEASE ON CULTURE-MEDIA.

(*a*) No growth—100 per cent. control; (*b*) partial control. The tubers from which these sclerotia were obtained had been soaked for ninety minutes in a 1–1,000 mercuric-chloride solution.

Photo by H. Drake.

The accompanying Graph 1 shows the results obtained from this experiment. In this and successive graphs the ordinate (vertical lines) show growth of sclerotia, the cipher O representing no growth or total killing, indicating that complete control has been attained; whereas the abscissæ (horizontal lines) represent strengths of the solutions used (unless otherwise stated). The series of curves given represent different times (in minutes) of immersion, acidity of solution, or strength of solutions. From Graph 1 it will be seen that the usual strengths of mercuric chloride recommended (1–1,000 or 1–2,000) do not give favourable results, for total killing is not obtained.

It was considered possible that the erratic nature of the curves obtained resulted from the frequent presence upon the sclerotia of air-bubbles, for it was noted at the time that these often persisted throughout the duration of the experiment. Therefore a second series of experiments was undertaken, in which the same strengths of solutions were used, and the tubers immersed for the same periods of time; but in addition the tubers were first presoaked for sixteen hours in tap water, it being considered that long immersion would tend to dispel the air-bubbles, and, permitting of the ready penetration of the mercuric-chloride solutions, tend to flatten the resultant curves. The time (sixteen hours) was merely an arbitrary one, being chosen for the reason that it would be most convenient to the farmer, who would require merely to place his tubers in water in the evening and have them ready for treatment in the morning.

In Graph 2 are shown the results obtained—results which are unsatisfactory both in point of time and killing, for it will be noted that, even after immersion for ninety minutes, solutions of a greater dilution than 1–750 do not give complete killing.

The latter experiment showed that lack of control was not due to imperfect penetration through interference by air-bubbles, so it was considered that greater concentration of solution might give satisfactory results. Therefore a further series of experiments was undertaken, in which tubers were immersed in various solutions for different times as follows:—

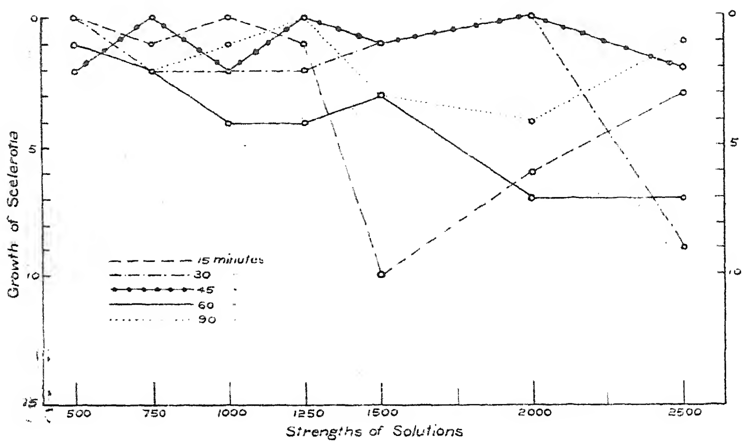
Third experiment—No presoak.
Fourth experiment—Presoak sixteen hours.
Solutions—Mercuric chloride, 1–200, 1–300, 1–400, 1–500, 1–750, 1–1,000.
Times of immersion—15, 30, 45, 60, 90, 130 minutes.

Results obtained showed that in Experiment 4 complete killing was obtained with solutions 1–200 to 1–500 (or 1–200 to 1–400 in Experiment 3) after immersion for two hours, but solutions weaker than this failed to give complete control. As the cost factor was considered to be such that solutions of 1–200 to 1–500 would be too expensive to use, a further series of experiments was undertaken in which solutions of Uspulun and copper sulphate were tried.

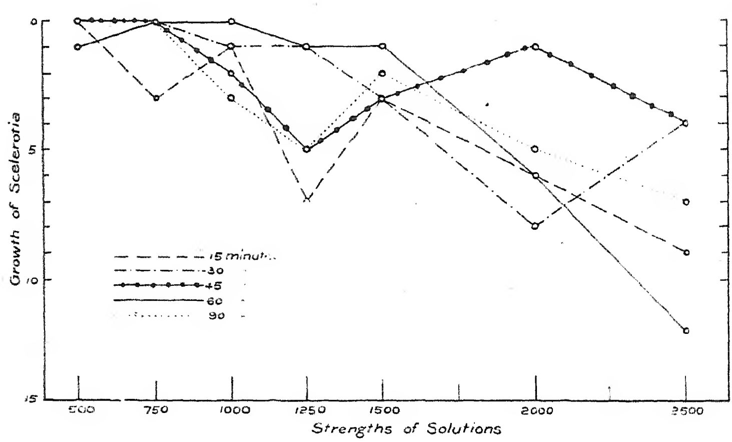
USPULUN.

This is a mercury-chloro-phenol compound, widely used to-day for the treatment of seed-wheat as a preventive of stinking-smut. In the experiment the following strengths of solution and times of immersion were used:—

Solution—1–400 (standard), 1–500, 1–600, 1–750, 1–1,000.
Times of immersion—15, 30, 45, 60, 90, 120 minutes.



GRAPH I. NO PRESOAK. MERCURIC-CHLORIDE TREATMENTS.



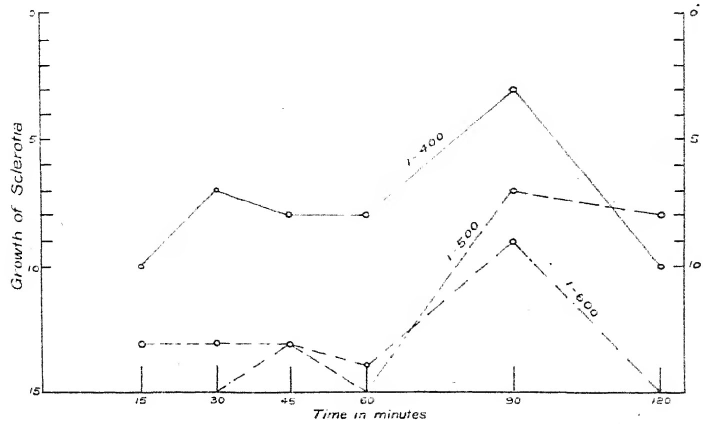
GRAPH 2. PRESOAK SIXTEEN HOURS. MERCURIC-CHLORIDE TREATMENTS.

These curves (time curves) show the effects of time of immersion and dilution of solutions on the killing of sclerotia.

Graph 3 (which differs from the preceding two in that the abscissæ give times of immersion in minutes and the curves strength of solution) shows that even after two hours' immersion 1–400 failed to give satisfactory control. Solutions 1–750 and 1–1,000 had no effect, for after two hours' immersion 100 per cent. growth was obtained from treated sclerotia.

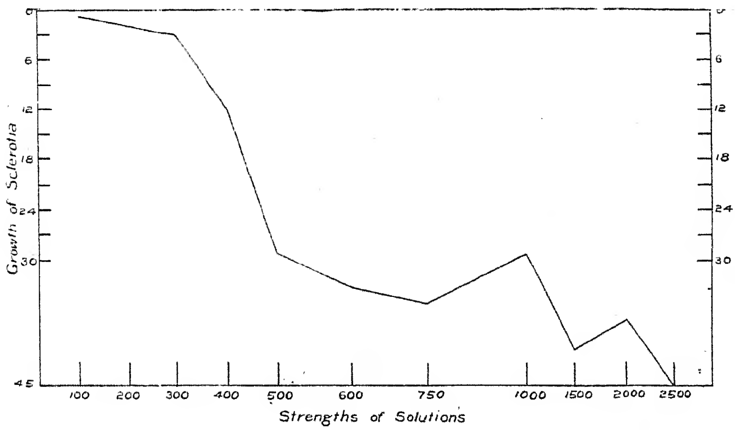
COPPER SULPHATE ($CuSO_4$).

Preliminary experiments with this fungicide gave every promise that it would prove a satisfactory if somewhat slower reagent than



GRAPH 3. "USPULUN" TREATMENTS.

These curves (solution curves) show the effects of different solutions on the growth of sclerotia. At no time is complete killing attained.



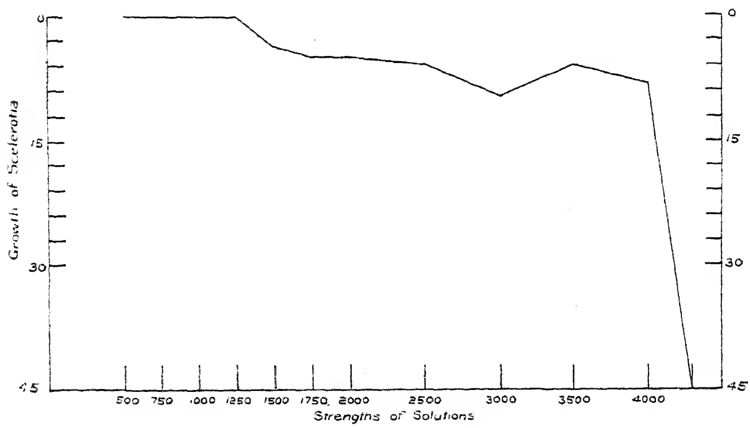
GRAPH 4. COPPER-SULPHATE TREATMENTS.

This curve shows the effect of sixteen hours' immersion in various solutions of copper sulphate.

mercuric chloride. Therefore a series of experiments was undertaken, in which tubers were immersed for sixteen hours in the following solutions: 1–100, 1–200, 1–300, 1–400, 1–500, 1–600, 1–750, 1–1,000, 1–1,500, 1–2,000. Graph 4 shows that even after this long immersion 1–100, the strongest solution used, would not completely kill all the sclerotia. In this last experiment nine tubers were used for each phase, instead of three as formerly. As these two compounds gave such unsatisfactory results, further experiments were undertaken with mercuric chloride.

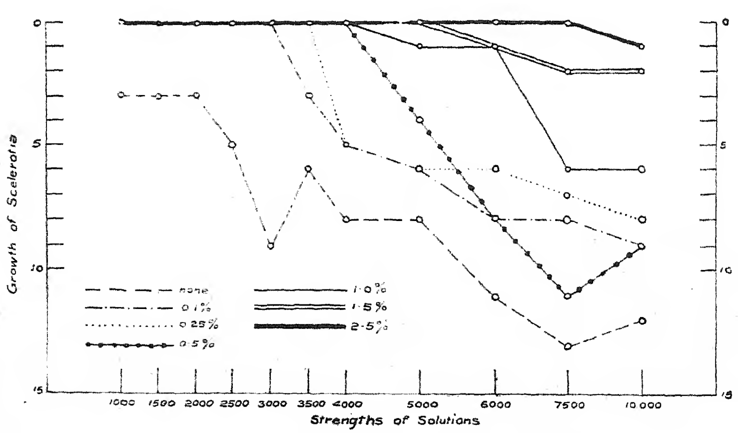
MERCURIC CHLORIDE (FURTHER SERIES).

In the next experiment (No. 17) tubers were immersed for sixteen hours (as in the previous experiment) at the following strengths: Mercuric chloride—1–500, 1–750, 1–1,000, 1–1,250, 1–5,000, 1–1,750, 1–2,000, 1–2,500, 1–3,000, 1–3,500, 1–4,000. Graph 5 gives a curve of the results obtained. It will be noted that even after sixteen hours' immersion solutions of a weaker concentration than 1,–1,250 did not give complete killing, thus demonstrating forcibly the fact that one of the standard treatments widely recommended—namely, immersion for two hours in 1–2,000—is ineffective.



GRAPH 5. MERCURIC-CHLORIDE TREATMENTS.

This curve shows the effect of sixteen hours' immersion in various solutions of mercuric chloride. Only solutions 1–500 to 1–1,250 give complete killing.



GRAPH 6. ACIDIFIED MERCURIC-CHLORIDE TREATMENTS.

Each curve (save the first) represents a different percentage of acid added to the solutions. Time of immersion, 2 hours.

As the result of a chemical and physical study of mercuric-chloride solutions it was decided to determine the effect of acidity upon their killing properties. Preliminary experiments gave such promising results that a wide series was planned. In the next experiment (No. 21) strengths of mercuric-chloride solutions were used as follows: 1–1,000, 1–1,500, 1–2,000, 1–2,500, 1–3,000, 1–3,500, 1–4,000, 1–5,000, 1–6,000, 1–7,500, 1–10,000. Each solution was made up in seven vessels, and to each was added hydrochloric acid (commercial concentrated, 31·5 per cent.) at the following percentage strengths: None, 0·1 per cent., 0·25 per cent., 0·5 per cent., 1·0 per cent., 1·5 per cent., 2·5 per cent.

Concurrently with this was run another experiment (No. 20) to determine the effect of hydrochloric acid alone on the growth of sclerotia. Tubers, in lots of three, were immersed for two hours in vessels containing water to which the following percentages of acid had been added:—

HCl—*a*, none; *b*, 0·1; *c*, 0·25; *d*, 0·5; *e*, 1·0; *f*, 1·5; *g*, 2·5.

When the cultures were examined twenty-four hours later it was seen that all sclerotia from tubers immersed in solutions *a* to *e* respectively were alive, while ten (out of fifteen) in *f*, and none in *g*, had germinated. In forty-eight hours all the sclerotia in *f* and *g* had germinated. Thus even a 2·5 per cent. solution of hydrochloric acid has little effect upon sclerotia other than to retard their germination for twenty-four hours. Therefore it may be asserted that the acid alone has no effect upon the germination of sclerotia.

In Graph 6 are given the results of Experiment 21. Here it will be noted that although unacidified solutions do not kill at any of the strengths used, when as little as 0·1 per cent. of hydrochloric acid is added killing is obtained even at a strength of 1–3,000. It will be noted that there is a definite relationship between the amount of acid added and the killing of sclerotia.

Further experiments have been carried out with regard to this work. These will appear in a subsequent paper, in which also will be given the cheapest and most economic method of control of corticium-disease.

LITERATURE CITED.

(1.) BISBY, G. R., and TOLAAS, A. G., 1920. Potato-diseases in Minnesota. *Univ. Minn. Agr. Exp. Stn. Bull. 190*, p. 20.

(2.) COONS, G. H., and KOTILA, J. E., 1923. Michigan Potato-diseases. *Mich. Agr. Exp. Stn. Bull. 125*, p. 50.

(3.) GLOYER, W. O., 1913. The Efficiency of Formaldehyde in the Treatment of Seed Potatoes for Rhizoctonia. *New York Agr. Exp. Stn. Bull. 370*, pp. 417–431.

(4.) GUSSOW, H. T., 1912. Report of the Botanist on Plant-diseases. *Canada Exp. Farms Rep.*, p. 200.

(5.) MCALPINE, D., 1911. Rhizoctonia Rot, or Potato Collar Fungus. *Potato-diseases in Australia*, p. 65.

(6.) NOBLE, R. J., 1924. Rhizoctonia Scab in Potatoes. *Ag. Gaz., N.S.W.*, vol. 35, p. 632.

(7.) ROLFS, F. M., 1903. *Corticium vagum* B. et C. var. *Solani* Burt, a Fruiting Stage of *Rhizoctonia Solani*. *Science*, vol. 2, p. 729.

(8.) —— Potato Failures: a Second Report. *Colorado Agr. Exp. Stn. Bull. 91*, p. 33, 1904.

(To be continued.)

WAX COATING OF CHEESE.

A RECENT TRIAL SHIPMENT.

W. E. GWILLIM, Assistant Director of the Dairy Division.

It is a common practice in the United States to coat with paraffin-wax cheese required for the domestic trade. The method was first introduced as a preventive measure against cheese-flies and the undue growth of mould. Incidentally it was found that the flavour of the cheese held better, and there was less loss in weight due to shrinkage. Some experimental work was carried out here several years ago, and a trial shipment of wax-coated cheese was made to the British market, but the results achieved did not appear to be sufficient to encourage further effort.

The method is not universally approved by the trade in Britain. Some traders have a prejudice against wax-coated cheese, which is attributed to the idea that when such cheese is cut up into pieces and exposed for sale the loss in weight is greater than with cheese which has not been so treated. On the other hand, many traders prefer wax-coated cheese, and will buy it whenever opportunity offers, provided the quality is right. A considerable amount of trade is done each season in wax-coated Canadian cheese. The buyers appear to be those who thoroughly mature their cheese before sale.

In February last a trial was undertaken in co-operation with the Kiritaki Co-operative Dairy Company (Hawke's Bay) for the purpose of obtaining further data as to the acceptability of wax-coated cheese on the British market, and ascertaining to what extent the wax coating affected the quality of the cheese in regard to the flavour and body, and on the mould-growth and saving in loss of weight. A number of cheeses were taken from three vats each day for seven days, and, after having been on the shelves for about fourteen days, one half of the number from each vat were coated with wax and the other half left unwaxed. The cheeses were duly forwarded to the grading-stores and graded in the usual way. The score-points awarded for quality and finish were the same in each case—namely, 44½ for flavour, 28½ for body and texture, 15 for colour, and 5 for finish, making a total of 93 points. The cheeses were uncased and weighed to the nearest ounce. Two months later the cheeses were regraded and reweighed singly in London by our Inspector, Mr. W. Wright. He reported as follows:—

"No cracked lips are visible on the paraffined cheese, and it seems as though the paraffining would solve the problem of preventing the cracking of the lips of the cheese made in the type of hoop in general use. The cheese can be made very pleasing for the counter trade, as the mould-growth is easily removed with a cloth. The cheese have taken and are holding the wax very well indeed. On no cheese has there been any flaking-off or breaking-away of the wax from the bandage. Each cheese was judged separately for quality, and the points averaged out as follows: Waxed cheese (nineteen crates)—43·94 points for flavour, 28·25 points for body and texture, 14·94 points

for colour; unwaxed cheese (nineteen crates)—43·23 points, 28·10 points, and 14·84 points respectively."

The loss in weight between the time the cheese was weighed in Wellington and reweighed in London was 0·56 per cent. in the waxed cheese and 1·54 per cent. in the unwaxed cheese. Arrangements had been made with the Kiritaki Dairy Company's selling agents in England to pass the cheese on to buyers specially interested in wax-coated cheese, but the arrangement could not be adhered to, as the cheese was selected to form part of the display of New Zealand dairy-products at the Wembley Exhibition.

SOME OF THE KIRITAKI CHEESE IN LONDON.

To left, unwaxed; to right, waxed.

[*Photo by W. Wright.*

As far as this trial was carried out it is evident that wax coating helps the quality of the cheese, minimizes mould-growth, and reduces shrinkage. Of these advantages the arrest of mould-growth is not the least important. On bare markets a little mould, and more especially that of a light-bluish colour, may pass without special comment, but on well-supplied markets it may be viewed disparagingly and to the disadvantage of the seller.

The coating of cheese with paraffin-wax is not a costly item. The wax used for the trial in question was purchased in Canada at about 3½d. per pound, and each cheese took about 3 oz. of wax. The plant used was a small vat fitted with a coil of steam-pipes, and cost £4 5s. About 100 lb. of wax was placed in the vat, and brought to and held at a temperature of about 210° F. Each cheese was dipped in the molten wax, held in it for about twenty seconds, and then withdrawn. Wax coating appears to be well worth the attention of manufacturers of cheese of the highest quality for sale on the British markets.

Persons employed on Farms.—According to a recently issued report of the Census and Statistics Office the number of persons employed on farms in New Zealand in 1923-24 was 145,158, compared with 146,380 in the preceding year. The figures for 1923–24 are classified as follows: Agricultural, 12,047 males, 2,785 females; dairying, 53,540 males, 24,605 females; pastoral and unspecified, 41,351 males, 10,830 females. "Persons employed" include working proprietors or managers and such members of their families as are employed during the major part of their time on the work of the farm. The persons enumerated are those regularly employed in rural pursuits. No attempt has been made to include temporary workers employed during harvest.

NOTES ON SOME MANURIAL EXPERIMENTS IN CANTERBURY AND OTAGO.

F. W. HILGENDORF, D.Sc., Canterbury Agricultural College, Lincoln.

In past years the Department of Agriculture made a great number of manurial and variety experiments in co-operation with farmers in many localities. The following notes refer to a series conducted in the South Island, chiefly by Mr. A. Macpherson, during the years 1911–16. A uniform plan of operations was followed until the war made certain manures scarce, and then the modification was the least possible. The trials were made on about a hundred farms, chiefly in Canterbury and Otago, and they lasted, as already indicated, for five seasons. By this means some very valuable figures were obtained, and any mistakes or inaccuracies due to soil or seasonal variations will have been smoothed out by the large number of the trials averaged in the following tables. By the use of tables of probability, too, any abnormal variations are taken account of, so that great confidence may be felt that the results of these trials will be reflected on the average of a series of years on a farm having the average soil and climate of the districts in which the trials were made.

Records of the experiments were published in various issues of the *Journal* during the period in question, and are indexed in the half-yearly volumes, also separately in the Consolidated Index for 1910–20 under the general heading of "Co-operative Field Experiments."

There is introduced into the tables that follow a column that requires some explanation. It is called "Odds in Favour of Significance." In any experiment repeated trials will give various results. For example, if one tosses six coins there may come up four heads or two heads instead of the expected three. The average of the first ten throws may be 3·5 or 2·5 heads, and yet the coins be quite normal. If this is so, then differences between 2·5 and 3·5 in an average of ten coin-tossing experiments do not mean anything, are merely chance, or, to use the common term, are not "significant." If, however, we tossed the six coins a thousand times and found then that on the average 3·5 or 2·5 heads had turned up at each throw, we would be justified in saying that there was a real difference between the chances of heads and tails turning up—that the difference between the number of heads and tails in the trials meant something, or was "significant"; and inspection would probably prove that some of the coins were heavier on one side than on the other. On observations such as these there has been built up a Theory of Probabilities, by which one can measure the chances that the difference shown between two series of experiments is a real one due to the different manure or variety, or only an accidental one due to variations in soil, seeding, weighing, recording, &c. It is these chances that have been calculated and entered in the column referred to. Odds of over 30 to 1 are regarded as practical certainty.

TURNIP MANURIAL TRIALS.

Those under consideration were conducted on five farms in Canterbury and forty-nine in Otago in the years 1911–16. In the cases where the same farm was used in two different years it is counted as two farms. In every case considered six plots were tried on the same farm, every series containing one unmanured plot, one with 1½ cwt. superphosphate, and so on. The results are given in tons per acre of roots alone, and the method of computation was that known as "Student's,"* each other plot being differenced against 1½ cwt. super, as that manuring may be considered standard practice. Plot 6 is, however, contrasted with Plot 5 for a reason obvious on examination.

Manure.	Number of Trials.	Yield.	Gain or Loss on 1½ cwt. Super.	Odds in Favour of Significance.
(1.) No manure	54	12·8	9·0 tons loss	Thousands to 1
(2.) 2 cwt. guano	54	20·6	1·2 tons loss	5 to 1
(3.) 1½ cwt. super	54	21·8	..	..
(4.) 3 cwt. super	54	22·4	0·6 tons gain	9 to 1
(5.) 2 cwt. super, plus ¾ cwt. bonedust	54	22·8	1·0 tons gain	24 to 1
(6.) No. 5, plus ½ cwt. sulphate of potash	54	22·7	0·1 loss on No. 5	1½ to 1

The great increase due to the use of 1½ cwt. super, or, rather, the great loss from not using super, is in accord with universal experience. The 2 cwt. guano gives less than super, and the chances are 5 to 1 that the difference is a real one. The 3 cwt. super gives an increase on 1½ cwt., but the chances in favour of significance are not large enough to allow a recommendation to adopt the practice. It was thought that by taking the results out separately for the wetter districts the 3 cwt. might show to greater advantage, but the information regarding the rainfall during the growing season was not obtainable, and computions from average yearly rainfalls gave no result.

A dressing of 2 cwt. super plus ¾ cwt. bonedust gave an increase of 1 ton per acre over 1½ cwt. super, and the chances are 24 to 1 that the difference is not due to the chance variations of the experiment, but is a real one that would be repeated under similar circumstances. Such odds in its favour cause this experiment to be worth very serious consideration. Of course it is impossible to say whether the increase is due to the added super or to the bonedust, but the absence of marked effect from the 3 cwt. super should cause the bonedust to be regarded with attention. The indications are that of the manures tried in this series 1½ cwt. to 2 cwt. super plus ½ cwt. of a slow-acting phosphate, such as bonedust or guano, will give the best results on turnips in Otago. It is a question for each individual farmer whether the extra ton of turnips per acre will pay for the increased manure.

The addition of potash gave no increase in yield.

A future article will deal with the manurial trials on other crops.

* An explanatory statement on this method by Dr. Hilgendorf is appended (next page), more particularly for the information of other experimenters or instructors.—EDITOR.

"STUDENT'S" METHOD OF COMPUTING PROBABLE ERROR IN AGRICULTURAL EXPERIMENTS.

F. W. HILGENDORF, D.Sc.

ONE of the best ways of conducting those agricultural experiments in which cumulative effect is not a prime consideration is to attack small questions one at a time, and lay out paired trials of the standard method *versus* the innovation, either in adjacent parts of the same field, or on different fields or farms, or in different years. In this way a great number of replicates can be made at once so as to reduce probable error, and soil variations are largely eliminated, since the two members of each pair of trials are on very similar soil. The differences only are computed, the actual yields of the two members of the pairs being of no direct interest.

For the past two years at Lincoln we have made large use of Beaven's half-drill strip method for this purpose, and find it conducive to accuracy of results combined with rapidity of handling. The middle coulter of the drill is blocked up, and half the drill is filled with each of the two varieties or manures. The drill is then driven wheel on wheel-mark up and down the field, and the result is that one gets pairs of plots sown for as long as one keeps drilling. We find from twenty to thirty pairs usually sufficient.

For computing the probable error of [the difference between paired trials "Student's" method is very suitable, because it is based on an estimation of the differences, which is what the experimenter is interested in, and because it takes cognizance of the correlation that exists between the members of each pair.

The method is adapted to any kind of paired experiments that can be devised, and so has been used for the manurial trials recorded elsewhere in this issue of the *Journal*, any two trials made on one farm in one year being regarded as a pair. The calculation is as follows: Find the difference between each pair of plots; enter each difference with its appropriate arithmetical sign. Find the mean difference M, with its arithmetical sign; find the difference d of each difference from the mean difference (their total = O), and finally square each d. Then, if n is the number of variates, the standard deviation $\sigma = \sqrt{\frac{\Sigma d^2}{n}}$ and $Z = \frac{M}{\sigma}$. The odds can then be found from the table appended. It will be noted that the factor ·67 used for turning standard deviation into probable error is not introduced. It has no particular advantage, and must not be used in conjunction with the table here quoted.

Example.

To find difference and the odds in favour of its significance between two manures applied to turnips on each of six farms:—

Year or Farm.	2 cwt. Guano.	1½ cwt. Super.	Difference.	d = Difference from Mean.	d^2.
A ..	10·21	9·61	−0·60	−1·28	1·638
B ..	26·82	31·80	+4·98	+4·30	18·490
C ..	9·43	8·42	−1·01	−1·69	2·856
D ..	27·11	27·22	+0·11	−0·57	·325
E ..	9·27	10·41	+1·14	+0·46	·212
F ..	24·21	23·67	−0·54	−1·22	1·488
Total ..	107·05	111·13	..	0·00	25·009
Difference	..	4·08	+4·08	..	..
Mean = M	..	..	+0·68	..	..

$$\sigma = \sqrt{\frac{25\cdot009}{6}} = 2\cdot04$$

$$Z = \frac{\cdot68}{2\cdot04} = \cdot33$$

and odds are by attached table about 4 to 1 that the difference is significant.

Skeleton Table of Odds for Z Values estimated by "Student's" Method.
(n = number of variates.)

Z.	n = 5.	n = 7.	n = 10.	n = 12.	n = 15.	n = 17.	n = 20.	n = 25.	n = 30.
0·2	1·82	2·12	2·55	2·84	3·29	3·60	4·08	4·94	5·90
0·4	3·27	4·48	6·67	8·45	11·8	14·5	19·5	31·4	49·3
0·6	5·75	9·42	18·0	26·8	47·3	68·4	117	277	666
0·8	9·82	19·5	49·3	88·3	207	356	832	3,332	9,999+
1·0	16·2	39·2	132	293	908	1,999	9,999+	9,999+	
1·2	25·9	75·9	344	908	3,332	9,999+			
1·4	35·8	119	666	3,332	9,999+				
1·6	60·0	255	1,999	9,999+					
1·8	86·7	434	4,999						
2·0	122	713	9,999+						
2·2	168	1,249	9,999+						
2·4	232	1,999	9,999+						

Some Cases of Practical Certainty.

$Z = \cdot7 \quad n = 12 \quad \text{odds} = 48\cdot5$
$Z = \cdot5 \quad n = 20 \quad \text{odds} = 46\cdot4$
$Z = \cdot45 \quad n = 25 \quad \text{odds} = 46\cdot6$

A much fuller table is given by H. H. Love, *Jour. Am. Soc. Agronomy*, vol. xvi, No. 1, 1924, p. 68.

FRUIT CONTROL ACT POLLS.

POLLS of producers taken during December with respect to bringing into operation the provisions of the Fruit Control Act, 1924, resulted in the First Part of the Act, relating to export control, being carried by a majority of 151 votes. The number of eligible votes was 291, of which 191 voted for and 40 against the proposal.

With respect to provincial control for fruit intended for sale on New Zealand markets, this proposal was negatived in each province as per the following figures :—

Province.	Eligible Electors.	Quota required.	Votes cast for Proposal.	Votes cast against Proposal.
Auckland	803	482	92	407
Taranaki	11	7	1	4
Hawke's Bay	373	224	54	92
Wellington	151	91	15	87
Marlborough	72	44	17	13
Nelson	590	355	270	147
Canterbury	356	214	21	214
Otago	361	217	32	123

Three informal votes were cast in Auckland and one in Nelson.

Although Nelson Province polled a large majority in favour of the proposal, the requisite 60 per cent. of eligible electors in favour was not obtained.

KIKUYU-GRASS IN AUCKLAND PROVINCE.

COMPARISON WITH PASPALUM.

A. G. ELLIOTT, Department of Agriculture, Auckland.

KIKUYU-GRASS (*Pennisetum clandestinum*) is a native of the Belgian Congo, and is now found generally in the African provinces. In Rhodesia it is one of the principal grasses, and is used in both pastures and playing-fields. The *Agricultural Gazette of New South Wales* for May, 1921, published a very comprehensive account of kikuyu, by J. N. Whittet, under the name of *Pennisetum longistylum*, but it was later established by E. R. Breakwell that the species mentioned was really *clandestinum*. In his recently published book, "The Grasses and Fodder Plants of New South Wales," Breakwell gives the history and quality of kikuyu both under Australian and African conditions.

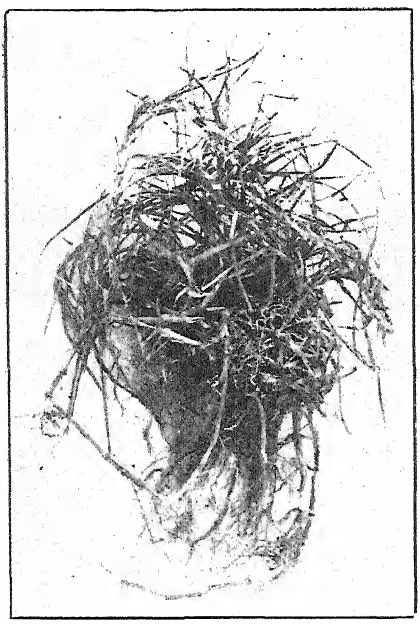


FIG. 1. KIKUYU-GRASS, SHOWING ROOT-SYSTEM, CREEPING STEMS, ETC.

The *longistylum* species was noticed over ten years ago by Mr. E. M. Ellin, growing vigorously on the sides of the Kiripaka Road, near Whangarei. Here it produces a quantity of coarse feed in the summer months, which even travelling stock will not touch. The grass is spreading both by seed and by surface and underground runners, but it is of practically no economic value, and may be classed among the so-called weed grasses. True kikuyu may be readily distinguished from the *longistylum* species not only by the quantity of feed produced, but also by the fact that while the former produces only a very reduced form of inflorescence and sets no seed, the latter has a good flowering-head and also seeds. *Pennisetum longistylum* was introduced here many years ago by a local nurseryman, Mr. David Hay, and it has also been identified growing in Victoria Avenue, Auckland. At the Ruakura Farm of Instruction the weed grass was also tried, but its small economic value was soon demonstrated wherever it was grown.

Kikuyu is a quick grower, spreading rapidly by means of surface and underground runners and an extensive root-system. It has the twitch habit of growth, and by this rapid production of new plants, especially from those roots which occur at the nodes on the surface runners, soon covers a large area. Fig. 1 shows these features and the

quantity of leafage thrown by this grass. In the issues of this *Journal* for May and October, 1921, December, 1922, and November, 1923, preliminary reports were given on results obtained with kikuyu at Albany and Puwera experimental areas.

INTRODUCTION AND TRIALS AT ALBANY.

Cuttings of kikuyu were introduced into New Zealand from Rhodesia by Mr. M. O'Brien, who was then on the staff of the Agriculture Department, at Wellington, and they were planted out at the Albany Experimental Area, near Auckland, in the spring of 1920. In a few weeks the plants were well established. A number of farmers who visited the area were so favourably impressed with the progress of the grass in the first season that they asked to be supplied with roots for trial. The roots were planted out in rows 3 ft. apart and 3 ft. between the rows, but during the first season this intervening area was covered by the runners. A small dressing of superphosphate was applied at planting, and on this and a larger plot which was laid down the next season an autumn top-dressing of superphosphate and basic slag was regularly applied with good results. Since it does not set seed the only means of propagating kikuyu is by planting of roots, and owing to lack of space, which precluded the carrying-out of more extensive trials at Albany, this centre is now used mainly for the distribution of roots to interested farmers who apply for them.

PUWERA EXPERIMENTS.

Roots forwarded from the Albany plot were planted out at Puwera, with a small amount of superphosphate, during November, 1920, and, as at Albany, the plants soon became well established. Visitors invariably expressed surprise at the vigorous growth of the kikuyu on this class of soil, which is typical of the stiff " pipeclay " gum-land. Experience at Albany had shown that, as with paspalum, the kikuyu becomes root-bound, and also requires top-dressing where it is not grazed by stock. In the second season at Puwera an area in the nursery was laid down with Lodino clover and kikuyu, and another with Lotus major, white clover, and kikuyu. The result was striking, since there was a remarkable improvement in the quality of the feed thrown by the kikuyu, which was very appreciably improved by the association with legumes. Both plots were grazed by a horse, and later cut for hay, which was of good quality and relished by stock. In experiments conducted at Kenya, British East Africa, clovers sown with kikuyu were entirely crowded out, and were only able to show up when the grass sward had been broken up.

FEEDING-TRIALS.

In September, 1922, an area of one acre was planted at Puwera with kikuyu roots, and later surface-sown with a mixture of red clover, white clover, and Lotus major. A good take resulted, and the whole area between the rows was well covered after the first season. This area throws a large quantity of succulent feed, most of which is produced between the months January to April. Figs. 2 and 3 show steers grazing on the plot, and give an indication of the close sward obtained with the kikuyu, Lotus major, and clovers. The cattle keep it closely grazed, and the area is very free from weeds, which

cannot compete with the grass. This plot has been top-dressed each season. In July, 1923, it received a mixture of 3 cwt. per acre of equal parts of superphosphate and basic slag, and in June this year superphosphate was applied at the same rate per acre. The results obtained have been gained by quite normal treatment in regard to stocking and top-dressing, and the cattle turned in on the kikuyu area have evidently found the pasture very palatable.

FIG. 2. STEERS GRAZING ON PASTURE OF KIKUYU, LOTUS MAJOR, AND WHITE CLOVER AT PUWERA EXPERIMENTAL AREA.

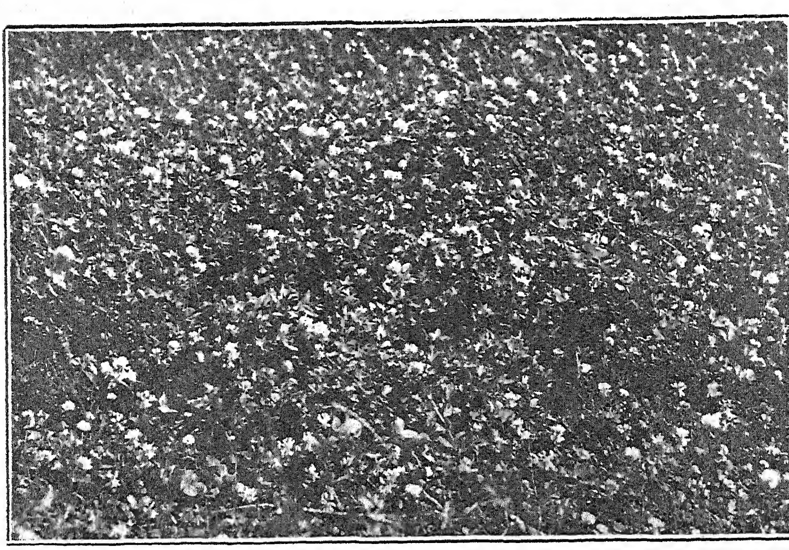


FIG. 3. A CLOSE VIEW OF THE PASTURE SHOWN IN FIG. 2.

WINTER GROWTH.

In order to get the best return from kikuyu it must be top-dressed. The two plots previously mentioned, in the nursery at Puwera, were top-dressed with superphosphate at the rate of 3 cwt. per acre in June, 1923. They were cut for hay in February of the present year, and later top-dressed in the autumn with the same fertilizer at the same acre rate. Fig. 4, the photograph for which was secured at the end of July, shows the vigorous winter growth of the kikuyu, which is usually regarded as a summer grass. This growth of the grass and the associated legumes is undoubtedly influenced by the phosphate top-dressing. When the cold, wet winter which was experienced at Puwera this year is taken into account it is evident

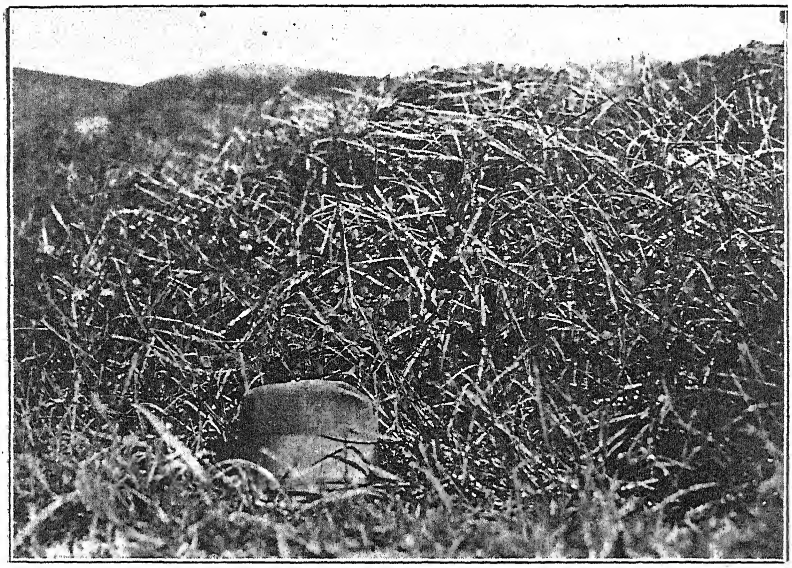


FIG. 4. WINTER GROWTH OF KIKUYU AND CLOVERS AT PUWERA.

that the result gained was in no way due to favourable climatic conditions. From experience gained since 1920 kikuyu had been of use only as a summer grass, having proved to be a good drought-resister and doing well on the poorer soils where English grasses could not be established. Its season, extending from October to May, was against its general use on dairy farms ; but if the winter growth obtained this year at Puwera can be relied on the value of kikuyu for North Auckland conditions will be greatly increased. Farmers' experience bears this out.

COMPARISON WITH PASPALUM.

At Puwera a further area of an acre was laid down in paspalum and white clover near the kikuyu area, and a third plot with paspalum

and cow-grass. The cattle have grazed these as well as the kikuyu plot, but have shown no very decided preference for any one plot. Kikuyu was much quicker and easier to establish than was paspalum, which at Puwera usually takes two years to become a good pasture-grass. The main requirement in North Auckland, apart from winter feed, is to provide sufficient grass and supplementary feed to carry dairy cows and other stock over the usually dry months of December, January, and February, and kikuyu was tested with this fact, among others, in view. Previously paspalum had provided in most cases the only feed for the dry period, and it was often the only sign of green to be seen at the time. The short season of paspalum, even under top-dressed conditions, is a very serious objection, unless it is kept well under control and used as a summer and autumn grass only. On the majority of farms it is not controlled at all, and yet for practically eight months of the year it does not produce succulent feed. In the Kaitaia district, in many cases, farmers have practised "fogging" instead of haymaking. Under this method the stock are turned in on the dry paspalum, which is often over 8 ft. high, and left to chew up the dried stalks and very small amount of short leaves. Under Puwera conditions kikuyu is quite as nutritious as paspalum, and in addition to this it has a longer growing-period

There is extra trouble involved in laying down an area in kikuyu, since roots must be either ploughed in or planted by hand, while in the case of paspalum seed (the average germination of which is about 30 per cent.) is usually sown. On the other hand, kikuyu is much quicker to establish than is paspalum, and also there is no danger of it spreading all over the farm by means of seed distributed in various ways by animals. In laying down a field in what is later intended to be a pasture consisting mainly of paspalum one of two methods is usually adopted. The most successful is to sow the paspalum-seed in the spring, together with clovers and Lotus major, and in this way quite a good sward is obtained for the second season. This method has proved very successful at Albany Experimental Area. Under the second method paspalum-seed is included in an autumn-sown mixture containing temporary and permanent elements, both of which must be used in just sufficient quantity to provide early feed and cover the ground, but not to depress the growth of the paspalum seedlings. Many areas intended for paspalum pastures in North Auckland have never done well owing entirely to the fact that too much Italian rye-grass was included in the mixture, and this strong temporary element crowded out the paspalum seedlings, which do not appear until the spring. Thus the special paspalum pasture was never a success on such areas, as subsequent top-dressing only assisted the more permanent elements, and also brought along such weed grasses and weeds which came in after the temporary grasses had run out.

To sum up the comparison, results to date show that kikuyu, under North Auckland conditions, produces a quantity of feed which is quite equal to that yielded by paspalum, and that it has a longer growing-period than the latter. Its ability to flourish on the poor clay hills where weeds cannot compete with it is also another advantage kikuyu has over paspalum, while the two points previously referred to—namely, its quick establishment and seedless habit—should also be kept in mind.

FARMERS' TRIALS.

During the last four years roots of kikuyu have been sent out to farmers who applied for them, and over ninety lots of cuttings have been distributed in this manner. Each season reports have been sent in by most of these men, and since the climate over the area from Kaitaia to Taumarunui varies a good deal, so the successes and failures with the grass have alternated. As would only be expected with a grass introduced from a tropical country, kikuyu did best under the warm conditions of North Auckland. In most places in South Auckland where it was tried, although producing feed by the middle of the first summer, it never recovered from the frosts. The majority of farmers in the northern districts who have tried kikuyu are very pleased with it, and they report that stock does well on the grass. In its second and third season many farmers had secured enough cuttings from their original supply to plant out a large area, and even now requests are received from farmers who wish to put down areas of from 5 to 10 acres.

Where it was tried in cultivated ground, however, the kikuyu soon became quite a menace to the other plants in the vicinity, and it was very difficult to eradicate. In two seasons a few roots, planted at a distance of 3 ft. apart, had covered an area 15 ft. long by 6 ft. wide. From its habit of growth one would expect to find this result, so that kikuyu should never be planted on such ground, but should be used on the poorer classes of soil where other grasses will not hold. On poor clay hills, where farmers report that it can be established, kikuyu should do well and throw a quantity of good feed, since the surface-sowing of Lotus major and white clover is an easy matter. Already on this class of country two species of Lotus occur naturally, and, as is shown at Puwera, the association of these with kikuyu gives a good sward.

EXPERIENCE IN OTHER COUNTRIES.

In the *Agricultural Gazette of New South Wales* for May, 1921, Whittet gives a good account of the trials with kikuyu in New South Wales, and also describes feeding-experiments which were carried out at Hawkesbury Agricultural College. In these latter trials kikuyu was found to be next to Hungarian brome in palatability, but was ahead of both timothy and cocksfoot. In this determination the grasses were cut and fed green to dairy cows for a certain period. Trials generally in New South Wales and Western Australia show that kikuyu does well in a variety of soils and climatic conditions, and produces most of its feed in the summer months. In the winter it lies dormant, but has proved to be a good drought-resister in summer. Roots were sent to Fiji from the Albany Experimental Area; reports show that the kikuyu is doing well on dairy farms, and it is expected that if the present successful sward can be maintained kikuyu will become one of the most important grasses there. Cuttings of roots were also forwarded to the Experiment Station at Honolulu, and the first report stated that the grass had become well established there.

CONCLUSIONS.

Kikuyu does well under the soil and climatic conditions of a great part of the Auckland Province, and is particularly suited to the Northern

Peninsula. Although most of the palatable feed is thrown between the months of December and April, by top-dressing with a phosphatic fertilizer a succulent winter growth is produced. The best results obtained from kikuyu have been gained where it has been used in association with a legume, white clover and Lotus major being the two most commonly sown. This pasture can be grazed, cut and fed green, or made into hay, which stock relish. Kikuyu stands drought well, and in addition to this it is able to successfully compete against young fern and manuka which come in on areas where reversion is taking place. Such reversion is common in North Auckland, and kikuyu may be an important factor in bringing what is now waste land into a state of production. If planted out in the spring the grass soon becomes well established and spreads rapidly. Once stock graze over these now useless areas the soil would be improved, the growth of fern and manuka checked, and the spread of the kikuyu assisted by the action of droppings. Under the conditions of Auckland Province kikuyu should be planted out only on such areas as cannot carry English grasses. As it is easily propagated from a small supply of roots the grass can in a few seasons be laid down wherever desired on the farm.

Further experiments in connection with grazing and top-dressing kikuyu are being carried out at Puwera this season. A large number of applications have been also received from farmers who wish to give the grass a trial this spring. Roots are distributed free in these cases, and reports are obtained from time to time from the farmers as to the value of the grass in their particular districts.

The conclusions drawn must be regarded as tentative for the present. Further results will be published after the trials have been continued over several seasons.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 13th November to 17th December, 1924, include the following of agricultural interest:—

No. 49657: Fertilizer; A. A. Adams, Auckland. No. 50017: Milking-machine measuring attachment; G. Harvey, Rata. No. 50446: Meat, fruit, and vegetables preservation; J. Cuthbertson, London, England. No. 50897: Ploughshare; C. H. Ensor, Rangiora. No. 51136: Plough; P. R. Spurr, Waitara. No. 51197: Plough-seat; W. Y. Cunningham, Gore. No. 52522: Dehorning-machine; P. J. Abraham, Ballygowan, Ireland. No. 51522: Cream-cooler; J. M. McDonald, Te Puke. No. 51263: Sheep-shearing machine adapter-plate; F. G. W. Bristow, Auckland. No. 51344: Driving-gear for separators; Massey-Harris Co., Ltd., Toronto. No. 52463: Wool-pack gripper; J. Kinlock, Timaru. No. 52737: Shearing-machine hand-piece tension-distributing means; C. H. Davis, Inverell, N.S.W. No. 52738: Hoe or seed-drill boot; C. Hunt, Beulah West, Vic. No. 52792: Harrow-link connection; S. J. Harding, Hinuera. No. 50627: Fruit-case; J. Brown, Birkdale. No. 51107: Incubator egg-tray; H. J. C. Williams, Christchurch. No. 51301: Milk-churn closure; E. Stanley, London, Eng. No. 51383: Milking-machine air-admission device; D. A. Hawken, Maunu. No. 52891: Butter-making process; Milk Oil Corporation, Wilmington, U.S.A. No. 53000: Rabbit-trap; J. Murray, Canberra, N.S.W.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price, 1s.

FARMYARD MANURE.

ITS CONSERVATION AND UTILIZATION.

W. J. McCULLOCH, Instructor in Agriculture, Palmerston North.

THE question which probably most exercises the mind of the average New Zealand farmer in regard to the use of farmyard manure is, "Does its fertilizing-value justify the expenditure of labour in conserving and subsequent utilization?" As the climatic conditions of this country do not demand that farm-animals should be housed continuously for lengthy periods each season, the quantity of manure collected at the average steading is relatively small. It is therefore very evident that the stock themselves are responsible for the distribution of the bulk of the manure, and in this way contribute very largely to the fertility upkeep of our farm lands. Hence also the value of using the tripod harrows at short intervals on the low-country pastures. This is plainly the most economical method of handling animal-manures.

In a consideration of the value of farmyard manure due allowance must be made for more than the actual commercial value of its fertilizing ingredients. It must be clear that the fertility of a soil is dependent upon more than the addition of so-called plant-foods. For instance, the humus content, which is one of the most important factors in fertility upkeep, can be largely depleted by the production of annual crops which are almost entirely removed. In order to be quite clear on the position one must first recognize that there is a distinction between what are known as manures and those termed artificial fertilizers, the chief difference being in respect to the other important functions of, for example, farmyard manure. For while an organic manure supplies plant-food, it also aids in the general improvement of plant-foods already in the soil to a very marked degree, while the artificial fertilizer as a rule only furnishes plant-food.

Another important factor of all fertile soils is texture, and here again farmyard manure exerts a very beneficial influence. The mechanical and physical benefits derived by soil from an addition of such manure are very important. The benefits extend alike to light and heavy soils. In light soils organic matter—frequently so deficient, and which no amount of artificial fertilizer can make up for—is supplied by farmyard manure, while at the same time the latter assists consolidation and retention of moisture. The advantages to heavy clay soils, although in a different direction, are no less marked. It makes their working much easier by opening the soil-mass to the beneficial influences of warmth, aeration, and oxidation. It will therefore be realized that farmyard manure is unique in its effect, and that it must be given credit for more than its actual commercial value as a plant-food.

The value of introducing and encouraging useful soil-bacteria is now well understood, and as an efficient supply of organic matter in a soil is known to be necessary for the growth and well-being of these organisms we realize a further important part played by the addition of farmyard manure. The manurial value of crops fed off on the ground

is universally recognized, yet the fact of the value of properly conserving farmyard manure continues, in many instances, to be neglected.

Much as we appreciate the value of an organic manure, it is often argued that the average New Zealand soils are not yet really deficient in humus, and that the necessity for the proper care and use of farmyard manure can quite easily be left in abeyance meantime. In answer to this statement it has to be remembered that the stables, cow-sheds, and yards must of necessity be kept cleared of manure, but there can be no real reason why it should be dumped in untidy heaps in odd corners and left lying at the mercy of heavy, washing rains, which remove in a liquid form to the nearest drain the most quickly soluble and available plant-foods. Even if it has to be looked upon as a necessary evil it must be handled and, sooner or later, the accumulation carted out and spread on some field. There appears to be no valid reason why a little extra care should not be taken to save the best of the material and utilize it as a fertilizer and soil-improver, while at the same time reducing annual expenditure on artificial fertilizers.

The ideal method would be to spread the manure daily and plough it in ; but this may be prohibitive on account of the labour involved, so that storage under reasonably good conditions will be the more convenient method. Where this can be accomplished under cover the value of the manure is greatly enhanced; but this may also be too expensive, so that the manure-heap in the open is likely to be more general. At the outset every attempt must be made to avoid drainage running from the heap, and if a concrete floor with shallow sides is out of the question, then a shallow depression should be scooped out, and if the bottom consists of an impervious clay all the better, as the object is to conserve all liquid. If the subsoil is loose, then a few loads of clay puddled on the bottom of the depression will answer. Should the circumstances prevent the scooping-out of a depression, then a ridge of loose soil can be spread round the outskirts of the heap, and as the moisture becomes absorbed it can be thrown on top of the manure-heap and replaced by more soil. In building the heap it should be kept evenly spread and level on top, consolidating the mass as much as possible in order to avoid undue heating. Horse-manure will heat readily if air is not excluded, especially if combined with too much straw. This causes a great loss of ammonia, and must be avoided as far as possible by mixing with alternate layers of cow or pig manure, or by pumping liquid manure on to the heap. Where none of these methods is practicable, and overheating occurs, a layer of soil should be spread on top of the heap. The soil will absorb most of the ammonia, and by consolidating the heap assist to prevent heating. It has often been suggested that gypsum, superphosphate, or kainit should be used as preventives against loss of ammonia in stables, but though good results have occasionally followed their use it is now recognized that all are open to objection, and they are not recommended. It is preferable to rely on straw or hay as a litter to absorb the moisture.

As an indication of the loss sustained by uncovered manure-heaps compared with those kept under cover, a few experiment-station

results may be here quoted. Rothamsted reports that covered manure increased the yield of potatoes by 7 cwt., and that of wheat by 5 bushels of grain and 4 cwt. of straw per acre. At Woking covered manure increased a wheat crop by 2 bushels of grain and 2 cwt. of straw per acre. The College of Science for Ireland, experimenting with potatoes, dressed two plots with farmyard manure at the rate of 18 tons per acre, one from a covered and the other from an open heap. The yield from the former plot was 9 tons $14\frac{1}{4}$ cwt. per acre, while that from the latter was 7 tons $14\frac{3}{4}$ cwt.

Every attempt should be made to save the liquid manure from the shed-drains. This manure should be drained into a tank or shallow concrete well placed below ground-level, and in a convenient position so that it may be pumped to a tank on a dray and directly applied to the field—preferably grassland. If conditions permit it may even be gravitated direct from the drains and used to irrigate the pastures. Failing both these methods it should be pumped on to the manure-heap. On no account should liquid manure be allowed to run to waste, as it contains a very appreciable amount of quickly available plant-food — approximately two-thirds of the total nitrogenous matter and four-fifths of the total potash (the phosphoric acid being mostly contained in the solids). It has been found that 1,500 gallons of liquid manure are equivalent to 150 lb. sulphate of ammonia and $4\frac{1}{2}$ cwt. of kainit.

As an addition to light soils farmyard manure should be well rotted (not firefanged) or what is generally termed "short." On the other hand, it should be "long" or strawy if for use on heavy or clayey soils. The straw which has been used as litter or bedding being more intact in the latter kind tends to keep the soil open, while in the former the well-rotted material brings about consolidation of the soil-mass and assists in retaining moisture, &c. Farmyard manure should rather be distributed over as large an area as is consistent with practical convenience, and so long as the distribution is even and in combination with artificial fertilizers applied separately, it will be found without exception that much better results will be obtained than if larger amounts of either are used separately. Farmyard manure varies much in composition, and although it is often called a complete manure it is not really well balanced, being usually deficient in phosphoric acid. For this reason it should be used in conjunction with one of the artificial phosphatic fertilizers.

As regards the time of year when farmyard manure should be applied, much depends on the circumstances. Where it is desirable to apply it to pastures it should be carted and spread during winter or early spring, and the field thoroughly tripod-harrowed as soon as practicable afterwards. For the growing of green fodders or roots it must be spread and ploughed in early, or some considerable time before sowing. Such crops as chou moellier, maize, thousand-headed kale, &c., being gross feeders, readily respond to an application of farmyard manure. In the case of the potato crop it can be spread between the ridges, together with artificial fertilizer, and the tubers planted, after which the whole will be covered by splitting the drills in the ordinary way.

TESTING OF PUREBRED DAIRY COWS.

DECEMBER CERTIFICATE-OF-RECORD LIST.

W. M. SINGLETON, Director of the Dairy Division.

THE appended list of C.O.R. certificates issued during December includes particulars of a number of creditable performances. Of these, two cows deserve special mention on account of their records constituting class-leaderships, as follows:—

AYRSHIRES.

Ivanhoe Stylish Daisy, a three-year-old Ayrshire which has gained a certificate on the production of 574·09 lb. butterfat, was bred, developed, and tested by Mr. A. M. Weir, of Menzies Ferry, and displaces the previous class-leader—Mr. C. E. C. Webb's Greenfield's Ina—by a margin of 8·07 lb. butterfat. The sire of Ivanhoe Stylish Daisy is Hindsward Jimmy, a bull which is fast making a reputation through the quality of his daughters. In addition to Ivanhoe Stylish Daisy he is sire of Ivanhoe Fancy (713·93 lb. butterfat) and Ivanhoe Fillpail (646·31 lb.), leaders of the four-year-old and mature Ayrshires respectively. Thus Hindsward Jimmy is sire of the leaders of three of the four classes into which this breed is subdivided. He is by the well-known imported sire Oxhill Jimmy. The dam of Ivanhoe Stylish Daisy is Maud of Inglewood, an untested daughter of Dandy Jim of Inglewood, who is by the imported bull Lessnessock Grandeur.

The year just ended has added several good records to the gradually lengthening list of Ayrshire C.O.R. cows, and it is hoped that this will be an incentive to followers of this breed to place purebred females under certificate-of-record test in greater numbers than has been the case in the past.

MILKING SHORTHORNS.

The change in class-leadership for the Milking Shorthorn breed falls in the senior four-year-old class. Matangi Violet 2nd, with 621·54 lb. butterfat, has exceeded the yield of her herd-mate and half-sister Matangi May 2nd by some 47 lb. butterfat. Matangi Violet 2nd was bred and tested by Messrs. Ranstead Bros., and is yet another champion daughter of Dominion Esau of Ruakura.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
		JERSEYS.					
Junior Two-year-old.		Yrs.	dys.	lb.		lb.	lb.
Fox's Golden Lady	L. and J. Griffith, Weraroa	1	359	240·5	365	13,998·2	617·54
Lynford Verbena	J. Murray, Woodville	2	10	241·5	365	10,261·7	562·71
Brooklyn Golden Belle	H. J. Lancaster, Glen Oroua	2	18	242·3	365	9,040·9	531·82
Oaklands Merry Princess	F. W. Cornwall, Bell Block	2	7	241·2	345	8,011·1	508·36
Golden Legend	L. and J. Griffith, Weraroa	1	330	240·5	365	11,794·3	497·24
Huimai Nancy Jean	J. Nicholson, Manakau	2	43	244·8	365	8,396·1	497·12

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
JERSEYS—*continued.*						
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Erinview Flo ..	J. Murray, Woodville ..	2 25	243·0	334	8,638·7	492·22
Keyflower	L. and J. Griffith, Weraroa	1 360	240·5	365	9,069·2	491·76
Waitapu Moral ..	E. Sinclair, Cheltenham ..	1 343	240·5	365	8,717·2	479·66
Riverswood Storm Lady	J. Nicolson, Kaupokonui ..	2 9	241·4	365	8,033·8	478·99
Linden Grove Diamond	M. A. Gadsby, Stratford ..	2 26	243·1	365	8,133·2	474·12
Waitapu Star ..	E. Sinclair, Cheltenham ..	1 285	240·5	365	8,889·8	439·68
Compensation ..	J. Nicolson, Kaupokonui ..	1 304	240·5	365	7,917·0	433·97
Riverswood Butter Girl	J. Nicolson, Kaupokonui ..	1 214	240·5	335	8,731·8	433·20
Holly Bank Maid ..	J. Nicolson, Kaupokonui ..	2 7	241·2	365	8,755·5	432·64
Riverswood Gold Cup	J. Nicolson, Kaupokonui ..	1 230	240·5	365	7,645·9	427·29
Double Duchess ..	A. J. Harris, Bombay ..	2 17	242·2	365	6,759·5	419·19
Rosy Creek Gleam ..	A. and J. O'Donnell, Hawera	1 357	240·5	365	7,108·7	415·01
Glenlivet Little Violet	W. S. Knuckey, Waitara ..	2 13	241·8	365	5·896·5	410·98
Pride Golden Hope ..	R. E. Clements, Awakino Pt.	1 309	240·5	365	6,871·5	409·15
Jersey Lea Trilby ..	L. and J. Griffith, Weraroa	1 317	240·5	365	7,948·2	408·71
Hawthorne Rosebud..	B. Roberts, Parkvale ..	1 313	240·5	365	6,889·6	403·56
Dorothy Storm ..	A. J. Dempsey, Horsham Downs	2 76	248·1	365	6,687·6	394·79
Ratanui Glory Lass ..	Boon Bros., Poroporo ..	1 346	240·5	359	7,156·5	393·43
Huimai Dianthus ..	J. Nicholson, Manakau ..	1 317	240·5	365	7,709·2	389·09
Vixen's Golden Ray..	R. E. Clements, Awakino Pt.	2 8	241·3	365	7,435·4	384·23
Milly Merit.. ..	F. S. Veale, Cambridge ..	1 328	240·5	365	5,722·9	382·23
Ratanui Zoraida ..	Boon Bros., Poroporo ..	2 24	242·9	355	9,087·0	381·91
Linden Grove Tiny Sunray	M. A. Gadsby, Stratford ..	1 336	240·5	365	7,727·0	381·48
Orange Dale Pearl ..	W. J. Hall, Matatoki ..	1 352	240·5	342	6,652·4	376·75
Waimarie Molly ..	H. G. Livingston, Kiwitea ..	2 2	240·7	347	5,843·5	368·44
Glenlivet Dora ..	D. L. A. Astbury, Mangatoki	2 1	240·6	365	6,453·8	349·91
Hawkesbury Marigold	W. I. Fallows, Puni ..	2 86	249·1	365	6,764·3	340·85
Soumise Buttercup ..	W. E. Wickham, Waitara ..	1 314	240·5	365	6,087·8	334·85
Arthingworth Ngati ..	E. Smallbone, Richmond ..	1 336	240·5	365	6,924·4	325·13
Mabelle Esquilant ..	G. A. Berry, Manaia ..	2 8	241·5	329	5,824·3	317·92
Luxury of Meadowbrook	J. O. J. Oliver, Temuka ..	1 281	240·5	365	5,652·1	296·54
Orange Dale Princess	W. J. Hall, Matatoki ..	2 11	241·6	270	5,155·0	289·62
Senior Two-year-old.						
Woodlands Faith ..	H. C. Sampson, Hillsborough	2 364	276·9	365	10,894·3	709·62
Uruti's Queen ..	W. Oxenham, Uruti ..	2 317	272·2	365	12,003·2	653·11
Llanvabon Briar Girl	L. W. and J. T. Prosser, Leeston	2 360	276·5	365	10,234·5	513·17
Erinview Molina ..	J. Murray, Woodville ..	2 337	274·2	365	11,343·9	506·20
Orange Dale Briar ..	W. J. Hall, Matatoki ..	2 360	276·5	365	8,333·5	427·09
Kuku Betty ..	R. L. Horn, sen., Ohau ..	2 336	274·1	320	8,927·8	404·22
Matai Nui Charmian..	D. L. A. Astbury, Mangatoki	2 199	260·4	365	7,094·4	389·45
Snowdrop's Hope† ..	J. McIvor, Ohaupo ..	2 325	273·0	365	5,952·6	327·01
Clarice	K. Rothe, Riverlea ..	2 272	267·7	346	6,265·8	309·64
Mauriaena Laura ..	Aickin and McCarroll, Woodhill	2 324	272·9	337	4,897·3	276·14
Three-year-old.						
Viola's Queen Bess ..	R. Cobbe, Aorangi ..	3 282	305·2	365	9,501·9	648·56
Llanvabon Dainty ..	L. W. and J. T. Prosser, Leeston	3 42	281·2	365	11,669·2	644·93
Lady Celia	E. Joyce, Kaponga ..	3 218	298·8	365	10,374·0	612·95
One I Love ..	G. E. Cowling, Manaia ..	3 347	311·7	365	10,546·6	602·46
Prim's Duchess ..	J. McIvor, Ohaupo ..	3 39	280·9	365	9,206·8	563·35
Brooklyn's Cream Lady	H. J. Lancaster, Glen Oroua	3 258	302·8	365	10,865·7	560·23
Marshland's Good Luck	W. J. Chynoweth, Hamilton	3 360	313·0	365	8,747·9	537·28

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Three-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Royton Vera ..	H. Moreland, Newstead ..	3 295	306·5	365	9,657·2	523·61
Lady Love's Farewell	L. W. and J. T. Prosser, Leeston	3 62	283·2	365	8,375·1	520·71
Dainty Bairn ..	K. Rothe, Riverlea ..	3 260	303·0	358	8,570·6	460·67
Oenothera	R. J. Wilson, Putaruru ..	3 344	311·4	304	9,299·6	425·92
Centuriana.. ..	J. Nicholson, Manakau ..	3 226	299·6	343	7,459·7	418·87
Neat Pride's Orphan	D. L. A. Astbury, Mangatoki	3 24	279·4	365	7,415·1	417·70
Clematis of the Meadows	R. Cobbe, Aorangi ..	3 363	313·3	365	6,815·4	400·04
Franella	G. A. Berry, Manaia ..	3 336	310·6	365	6,814·4	397·50
Four-year-old.						
Lady Knight* ..	F. J. Finer, Ngutuwera ..	4 75	321·0	365	10,670·2	675·35
Erinview Maid† ..	J. Murray, Woodville ..	4 12	314·7	365	11,812·7	661·81
Volpes' Streamlet† ..	H. R. Benbow, Ormondville	4 20	315·5	328	10,292·1	621·03
Orange Dale's Larkspur	W. J. Hall, Matatoki ..	4 34	316·9	365	9,984·4	615·17
V.A.D.	A. R. Clark, Hamilton ..	4 22	315·7	365	10,497·2	608·96
Viola's Golden Fern ..	R. Cobbe, Aorangi ..	4 22	315·7	365	10,336·2	602·17
Oaklands Guernsey ..	F. W. Cornwall, Bell Block	4 72	320·7	303	9,551·7	595·55
Fox's Snow ..	H. J. Burrell, Bunnythorpe	4 81	321·6	365	9,107·0	560·01
Twist	J. S. T. Short, Hawera ..	4 324	345·9	365	10,240·3	494·96
Sweetest Joy ..	M. A. Rogers, Katikati ..	4 226	336·1	365	8,462·7	489·44
Flower's Pearl ..	H. Moreland, Newstead ..	4 304	343·9	365	7,858·4	434·15
Heartsease	J. S. T. Short, Hawera ..	4 346	348·1	350	7,571·9	408·40
Lady Kaepe ..	G. A. Berry, Manaia ..	4 256	339·1	365	7,466·4	378·87
Mature.						
Mountain View's Pansy	J. Murray, Woodville ..	10 29	350·0	365	12,456·9	687·56
Maori Countess ..	H. B. Lepper, Lepperton ..	7 346	350·0	365	12,773·3	675·68
Waipiko Prudence ..	C. G. C. Dermer, Cheltenham	7 2	350·0	365	13,047·3	664·93
Reid Park's Queen ..	G. Bright, Otaua.. ..	8 54	350·0	365	10,870·9	661·38
Vileta	J. S. T. Short, Hawera ..	5 283	350·0	365	11,409·3	642·50
Bright Eyes Favourite	L. W. and J. T. Prosser, Leeston	5 85	350·0	365	11,542·3	639·56
Sappho's Model ..	S. Dale, Fairlie	5 296	350·0	365	10,963·1	611·39
Norah of Konini ..	T. H. Verry, Pahiatua ..	6 316	350·0	365	10,357·9	607·02
Golden Evening ..	K. M. Stevens, Maungatapere	8 55	350·0	365	10,411·4	598·30
Waipiko Leno ..	C. G. C. Dermer, Cheltenham	5 51	350·0	342	10,664·0	592·38
Gold Ring	H. R. Benbow, Ormondville	8 273	350·0	365	11,091·1	592·25
Fern Grove Louise ..	H. J. Burrell, Bunnythorpe	7 39	350·0	349	10,798·0	582·93
Bronze	D. L. A. Astbury, Mangatoki	7 340	350·0	365	9,802·3	539·11
Grannie's Beauty ..	A. J. Smith, Cardiff ..	5 68	350·0	364	10,376·3	536·11
Wai Whenua Duchess	R. J. Wilson, Putaruru ..	8 337	350·0	346	9,190·1	520·51
Waipiko Billet Doux	W. J. Chynoweth, Hamilton	6 17	350·0	365	9,982·7	507·12
Illusion	D. P. F. Maole, Kaponga ..	5 343	350·0	343	10,351·2	505·60
Starlight's Mary Chase	W. J. Hall, Matatoki ..	9 300	350·0	365	8,525·0	504·97
Lady Adelaide ..	H. Moreland, Newstead ..	10 326	350·0	365	9,670·7	502·31
Dairy Lass's Queen ..	H. J. Lancaster, Glen Oroua	8 53	350·0	339	7,684·6	502·00
Flower's Joy ..	D. L. A. Astbury, Mangatoki	6 312	350·0	365	9,994·3	496·54
Reid Park's Snuff Box	A. H. Ellicott, Hamilton ..	6 362	350·0	365	10,695·0	487·29
Bilberry's Lass ..	R. J. Wilson, Putaruru ..	5 279	350·0	340	8,428·4	476·80
Primrose Chase ..	W. J. Hall, Matatoki ..	7 304	350·0	365	8,211·9	463·61
Hope's Girl ..	A. H. Ellicott, Hamilton ..	6 61	350·0	365	8,910·1	460·09
Wai Whenua Flower	R. J. Wilson, Putaruru ..	7 309	350·0	365	8,342·8	457·21
Kitty Mahone ..	K. M. Stevens, Maungatapere	8 298	350·0	365	8,631·7	456·31
Golden Sunray ..	A. Mouldey, Tirau ..	9 326	350·0	353	7,812·9	433·67

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
JERSEYS—*continued.*						
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Ariadne's Belle ..	H. O. Washbourn, Richmond	7 27	350·0	365	7,925·3	410·81
Golden Grape ..	K. M. Stevens, Maungatapere	7 58	350·0	346	7,730·5	377·54
FRIESIANS.						
Junior Two-year-old.						
Coldstream Favourite*	V. Marx, Mangatoki ..	1 357	240·5	365	15,256·8	547·27
Brookside Domino Maid†	Cameron Bros., Stratford ..	1 347	240·5	365	13,267·7	477·18
Coldstream Pontiac Princess 2nd*	Marchant and Sons, Cardiff	1 355	240·5	348	10,849·1	453·60
Dominion Azalia 2nd	Central Development Farm, Weraroa	2 36	244·1	365	14,846·4	452·93
Dominion Olga of Rock	Central Development Farm, Weraroa	1 348	240·5	365	10,748·9	440·19
Ellerlea Ena Minto de Kol*	A. C. M. Finlayson, Kamo ..	2 10	241·5	365	11,496·1	427·84
Hanley Transvaal Darkie†	G. H. Hassall, Clarkville ..	2 30	243·5	365	11,055·5	425·39
Dominion Frisby Beets	Central Development Farm, Weraroa	1 362	240·5	365	14,247·1	406·10
Rosevale Inka Lassie*	McDonald and Co., Dunedin	2 25	243·0	365	11,295·7	356·36
Dominion Princess Inka Pietertje	Central Development Farm, Weraroa	1 290	240·5	349	11,096·9	347·29
Dominion Woodcrest Manola	Central Development Farm, Weraroa	1 344	240·5	337	10,721·0	344·46
Rosevale Pet Plus Triumph*	McDonald and Co., Dunedin	1 320	240·5	365	9,984·7	341·30
Longbeach Buttercup 6th*	J. H. Grigg, Longbeach ..	2 81	248·6	365	9,506·7	334·46
Dominion Miss Tromp	Central Development Farm, Weraroa	1 325	240·5	365	10,383·7	333 69
Ellerlea Rag Apple Minto de Kol*	A. C. M. Finlayson, Kamo ..	2 38	244·3	363	9,563·9	325·78
Everslea Lotje Girl† ..	Muff Bros., Orari.. ..	1 356	240·5	365	9,107·4	320·44
Dominion Queen Segis of Rock	Central Development Farm, Weraroa	1 349	240·5	355	9,831·7	312·33
Everslea Medbury Lucy*	Muff Bros., Orari.. ..	1 244	240·5	365	9,341·9	309·03
Ellerlea Biddy Minto de Kol*	A. C. M. Finlayson, Kamo	2 27	243·2	365	8,139·6	289·49
Senior Two-year-old.						
Bainfield Woodcrest Sylvia Pauline*	F. Smedley, Te Awamutu ..	2 273	267·8	365	20,564·6	681·91
Hanley Betty† ..	G. H. Hassall, Clarkville ..	2 310	271·5	339	11,751·0	421·81
Junior Three-year-old.						
Tunanui Ashlynn Rosebud†	A. H. Russell, Hastings ..	3 171	294·1	365	17,675·3	629·07
Springtime of Oakview 3rd*	H. R. Green, Kairanga ..	3 69	283·9	326	15,129·9	546·35
Ryvington Rosette† ..	Hodgson Estate, Tamahere	3 8	277·8	337	14,500·6	470·93
Bainfield Topsy 10th*	W. D. Hunt, Invercargill ..	3 88	285·8	221	11,536·8	468·41
Carlyle Anenome† ..	Piri Land Company, Orini..	3 51	282·1	365	11,609·9	462·25
Dominion Mierlo Mercedes	Central Development Farm, Weraroa	3 7	277·7	326	10,877·3	301·84

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS—*continued.*				
Junior Four-year-old.		Yrs. dys.	lb.		lb.	lb.
Galatea Segis of Ngatoro†	Piri Land Company, Orini ..	4 92	322·7	365	17,184·9	599·44
Fairmont Pietertje Lady*	J. Hart, Tatuanui ..	4 27	316·2	274	13,461·8	532·86
Senior Four-year-old.						
Dominion Jessie Fobes	Central Development Farm, Weraroa	4 308	344·3	265	12,746·1	406·15
Mature.						
Alcartra Rozine de Kol†	A. W. Chapman, Gordonton	10 11	350·0	365	22,986·9	792·81
Forest Johanna† ..	Cameron Bros., Stratford ..	6 325	350·0	365	18,068·7	690·44
Weston Lea Fancy de Kol*	E. F. Peacocke, Hamilton..	6 100	350·0	365	16,417·9	629·25
Riverdale Blackberry*	E. F. Peacocke, Hamilton..	8 311	350·0	365	18,947·6	618·08
Coldstream Princess Inka Pieterje*	Marchant and Sons, Cardiff	5 49	350·0	282	17,174·5	601·86
Clothilde Alcartra Fayne†	A. W. Chapman, Gordonton	8 60	350·0	321	18,734·0	600·73
Cluny Hengerveld Rosebud 2nd†	A. H. Russell, Hastings ..	8 86	350·0	365	17,044·0	591·40
Weston Lea Snowdrift de Kol*	E. F. Peacocke, Hamilton ..	6 87	350·0	365	17,315·3	585·17
Woodcrest Gem† ..	A. H. Russell, Hastings ..	8 73	350·0	339	11,938·0	379·91
		MILKING SHORTHORNS.				
Senior Two-year-old.						
Brookside Peggy ..	J. Pease, Matatoki ..	2 361	276·6	365	6,735·25	293·76
Senior Three-year-old.						
Vale Royal Doffie ..	W. Bowis, Doyleston ..	3 361	313·1	352	10,900·5	386·28
Junior Four-year-old.						
Brookside Beauty ..	J. Pease, Matatoki ..	4 32	316·7	365	11,336·75	454·64
Senior Four-year-old.						
Matangi Violet 2nd† ..	Ranstead Bros., Matangi ..	4 303	343·8	365	14,383·7	621·54
Matangi Clara 2nd† ..	Ranstead Bros., Matangi ..	4 325	346·0	325	11,689·6	455·77
		AYRSHIRES.				
Three-year-old.						
Ivanhoe Stylish Daisy*	A. M. Weir, Menzies Ferry	3 312	308·2	365	12,334·2	574·09
Ivanhoe Nora* ..	A. M. Weir, Menzies Ferry	3 282	305·2	358	10,999·7	454·53
Four-year-old.						
Birchwood Favourite 1st*	T. G. Dobbie, Menzies Ferry	4 1	313·6	365	13,400·9	566·27
White Heather of Ashleigh Park†	C. B. Morgan, Ngawapurua	4 2	313·7	365	11,594·8	465·61
Mature.						
Ivanhoe Rubina* ..	A. M. Weir, Menzies Ferry	6 337	350·0	365	12,600·6	497·35
Ivanhoe Blanche* ..	A. M. Weir, Menzies Ferry	..	350·0	365	12,906·7	459·39
Chloe of Waiuku ..	N. Brown, Buckland ..	9 49	350·0	339	9,633·0	385·55

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat reqd for Cert.	Yield for Season. Days.	Milk.	Fat.
	RED POLLS.					
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Dominion Sylphide ..	Central Development Farm, Weraroa	1 339	240·5	341	8,651·1	430·74
Dominion Birdseye ..	Central Development Farm, Weraroa	1 292	240·5	338	6,704·7	332·59
Three-year-old.						
Dominion Rhodesia ..	Central Development Farm, Weraroa	3 23	279·3	333	7,096·2	327·55
Four-year-old.						
Dominion Ruapehu ..	Central Development Farm, Weraroa	4 24	315·9	333	7,735·1	335·02
Mature.						
Dominion Riverina ..	Central Development Farm, Weraroa	5 241	350·0	296	8,012·7	379·52

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat reqd for Cert.	Days.	Milk.	Fat.
	JERSEYS.					
Senior Two-year-old.						
Ku Ku Pearl ..	R. L. Horn, sen., Ohau ..	2 280	268·5	365	12,591·5	565·91
Palmdale Golden Dawn	D. Kennedy, Morven ..	2 359	276·4	365	9,775·0	559·05
Marshlands Tango ..	W. J. Chynoweth, Hamilton	2 363	276·8	365	7,723·6	477·47
Mauriaena Fairy ..	Aickin and McCarroll, Woodhill	2 265	267·0	365	7,072·1	417·25
Three-year-old.						
Folly's Pet.. ..	G. A. Gamman, Marton ..	3 273	304·3	365	9,419·7	532·20
Awatane Dorcas ..	J. Nicholson, Manakau ..	3 123	289·3	365	11,056·1	487·23
Four-year-old.						
Golden Vein ..	G. E. Cowling, Manaia ..	4 309	344·4	365	11,921·3	692·29
Mature.						
Della	J. Nicholson, Manakau ..	7 294	350·0	365	9,336·1	546·66
	FRIESIANS.					
Mature.						
Colantha Know-not*	R. C. Allen, Annandale ..	8 263	350·0	365	22,921·9	705·50
Friesland Park Alba Colantha*	Muff Bros., Orari.. ..	9 233	350·0	365	16,191·5	541·46

Noxious Weeds Orders.—Gorse has been declared to be a noxious weed within the Borough of Opotiki. The Borough of Balclutha has declared Californian thistle and ragwort *not* to be noxious weeds within its boundaries.

Green and Root Crops and Hay.—The area of grasses and clovers (including lucerne) cut for hay in 1923–24 increased by 13,421 acres compared with 1922–23; potatoes and mangolds increased by 896 and 295 acres respectively. Green-fodder crops decreased by 9,765 acres, turnips by 15,593 acres, and onions by 163 acres.

The Waiapu Pastoral and Industrial Association has been incorporated under the Agricultural and Pastoral Societies Act.

CONTROL OF ORCHARD AND GARDEN PESTS AND DISEASES.

Horticulture Division.

It is important to distinguish between the different pests and diseases that attack fruit-trees, otherwise a great deal of time and material will be wasted in useless attempts to control them by the application of wrong spraying-mixtures. If the nature of the disease is known the remedy is more easily determined. It may therefore be of value to here place the principal diseases in their respective classes, and likewise the spraying-materials most generally in use in a corresponding class. These can be used for reference when considering the methods of control.

Pests.	*Controls.*
Chewing-insects	Poison sprays.
Sucking-insects	Contact sprays (insecticides).
Diseases.	
Fungoid diseases	Fungicides.

CHEWING-INSECTS.

Chewing-insects comprise those that chew and eat their food, whether it be leaf or fruit. The following are the most common and destructive: Codlin-moth, leaf-roller caterpillar, pear-slug, bronze-beetle, raspberry-bud weevil, tomato-caterpillar.

POISON SPRAYS.

Arsenate of lead is now almost universally used, and answers practically all purposes. Use $1\frac{1}{2}$ lb. of arsenate-of-lead paste or $\frac{3}{4}$ lb. of powder to 50 gallons of water (2 oz. paste or 1 oz. powder to 4 gallons water). In the case of pip-fruits commence spraying as soon as the majority of the petals have fallen, and repeat the application at intervals of fourteen to twenty-one days throughout the season, the main object being to keep the fruit and foliage thoroughly covered with the spray. Applications to late varieties of apples are often discontinued too soon, and the crop is packed while infected with leaf-roller caterpillar, with great resultant loss.

SUCKING-INSECTS.

Sucking-insects comprise those that feed upon the juices of the fruit, stem, and foliage by means of a proboscis which penetrates the surface and sucks up the natural juices of the plant. The following are the principal orchard insects in this class: Mussel, San José and other scale insects, mealy bug, woolly aphis and other aphides, red mite, pear-mite, thrips, and leaf-hoppers.

INSECTICIDES (CONTACT SPRAYS).

Red-oil emulsion has proved most effectual for these pests on fruit-trees. There are numerous brands of commercially-prepared oils on

the market, needing only the addition of soft water to make them ready for use. They are quite easy to mix if the following instructions are carried out: Take one part of red oil and place it in a bucket (a benzine-tin answers admirably). Next take one part water and pour this into the vessel containing the oil. Stir or agitate the mixture, and an emulsion is readily formed. It is then ready for further dilution as may be required. Should the water be very hard a little soda should be dissolved in it before mixing.

The following strengths are recommended, but may vary slightly according to the locality and time of application :—

Pip-fruits.—1 gallon red oil to 10–15 gallons water, applied towards the end of August or the beginning of September. Trees badly affected with woolly aphis may be sprayed with red oil, 1–60, as soon as the fruit is gathered.

Stone-fruits.—1 gallon oil to 12 or 15 gallons water, in early spring, but when the trees are dormant. Trees affected with San José scale in autumn should be cleaned up with lime-sulphur sprays before they become dormant.

Citrus-fruits.—1 gallon oil to 40 gallons water. Apply in spring, after an inch or so of growth has been made; also in autumn, towards the end of March, when the summer crop has been gathered.

Nicotine Concentrate (Black Leaf 40).—This is a safe and efficient insecticide for use during the growing-period. Use one part of Black Leaf 40 to 1,200 parts of water, first adding 3 lb. or 4 lb. of dissolved soap to the 100 gallons water. The soap is an important ingredient, but when using Black Leaf 40 in combination with other sprays the soap should be omitted.

Lime-sulphur Concentrate.—This mixture has some insecticidal qualities; they are chiefly useful in the control of red mite and San José scale. For details of strength of mixture see "Fungicides."

FUNGOID DISEASES.

Following are some of the principal fungoid diseases: Black-spot on apple and pear, leaf-curl on peaches and nectarines, bladder or pocket plums on plums, powdery mildew on apples, shot-hole fungus on apricots, brown-rot of stone-fruits, and verrucosis of citrus-fruits.

FUNGICIDES.

There are three in general use :—

(1.) *Bordeaux Mixture.*—In this the active agent is bluestone (sulphate of copper) temporarily neutralized by combination with quicklime, both being dissolved in water. In recipes the ingredients are quoted in this order. The right method of mixing these ingredients is most important and should be carefully followed. To make bordeaux, 8–6–50, dissolve 8 lb. bluestone in 25 gallons water. This may be done by placing the bluestone in sacking and suspending it in the water. Take 6 lb. of good quicklime and slake it in another barrel, using a small quantity of water; then dilute it up to 25 gallons. Pour the two solutions simultaneously into the spray-tank, and the mixture will

be ready for use. The best results are obtained when the application is made as soon as possible after blending the two solutions. If allowed to stand over eight hours the fungicidal properties largely depreciate. Stock solutions of the ingredients may be kept satisfactorily, but, as just stated, they should not be mixed until required. Bordeaux should be neutral or slightly alkaline; it should never contain an excess of copper sulphate. It should give no reaction to litmus paper. A bright steel knife-blade dipped in the acid mixture is quickly covered with a deposit of metallic copper. Again, free copper is quickly detected if a little of the mixture is placed in a saucer and a drop of solution of ferro-cyanide of potassium is poured on it, when it will immediately assume a muddy brown appearance. This precaution is important when spraying during the growing-period.

(2.) *Lime-sulphur.*—This is sulphur made into a liquid form by boiling it in lime-water. Large users generally make their own. It may be made as follows: Sulphur, 100 lb.; rock lime (95 per cent. pure), 50 lb.; water, 50 gallons. Slake the lime carefully and strain it into an iron boiler. Mix the sulphur to a paste and add it to the lime-water, also sufficient water to make it up to 50 gallons. Boil the mixture until all the sulphur is dissolved (about an hour), taking care to replace the water evaporated. Solutions made in this way usually register 20° to 25° Beaume. To make correct dilutions the specific gravity of the concentrate should be ascertained by means of the Beaume hydrometer, and reference made to the dilution table on page 48.

(3.) *Finely Precipitated Sulphur (In Paste Form).*—The commercial proprietary preparations of this material are generally used.

CONTROL TREATMENTS.

Apple, for Black-spot and Powdery Mildew.—In spring, as the buds are breaking (green-tip), apply lime-sulphur (33° Beaume test), 1–10. As the flower-buds break (pink), make another application, 1–35 or 1–50. When the petals fall give the calyx spray, 1–80 or 1–100. Follow at intervals thereafter, as required, at 1–125. In some localities it has been found necessary to use the stronger fungicide bordeaux, 6–4–50, at the green-tip, and 3–4–50 at the pink stage, subsequent sprays being lime-sulphur, 1–100 or 1–125. On some varieties the use of bordeaux has a tendency to cause russeting of the skin of the fruit. Some varieties that are specially tender, and trees in weak condition, are sometimes sprayed at the calyx stage and after with finely precipitated sulphur, 1 lb. to 8 or 10 gallons of water. (See illustration of various stages of blossom-development.)

Pear, for Black-spot.—Apply bordeaux, 6–4–50, at green-tip, 4–4–50 at the pink, and 3–4–50 at the calyx stage; and at intervals thereafter as required.

Stone-fruits, for Leaf-curl, Shot-hole, Bladder-plum, and Brown-rot.—Apply bordeaux, 8–6–50, as the buds commence to move, and 6–4–50 at the pink stage. Where brown-rot is prevalent trees should be sprayed with lime-sulphur, 1–125, when the fruit has set, and at intervals of about twenty-one days thereafter till within a week or so of picking. It is also necessary to go over the trees carefully every week during the fruiting season and gather and destroy affected fruit.

STAGES OF APPLE-BLOSSOM DEVELOPMENT.

(1) Green-tip; (2) tight-cluster; (3) open-cluster; (4) pink; (5) full-bloom; (6) petal-fall; (7) calyx-closed.

[*Drawing by N. J. Adamson.*

REFERENCE TABLE FOR STANDARDIZING HOME-MADE LIME-SULPHUR SOLUTION BASED ON A 33° BEAUME STANDARD.

Beaume.	1–10.	1–15.	1–20.	1–25.	1–30.	1–40.	1–50.	1–60.	1–70.	1–80.	1–90.	1–100.	1–110.	1–120.	1–125.
15° ..	4·6	6·8	9·1	11·4	13·6	18·2	22·8	27·3	31·8	36·4	40·9	45·5	50·0	54·5	56·8
16° ..	4·8	7·3	9·7	12·1	14·5	19·4	24·3	29·1	33·9	38·8	43·6	48·5	53·3	58·2	60·6
17° ..	5·2	7·7	10·3	12·9	15·5	20·6	25·8	30·9	36·1	41·2	46·4	51·5	56·7	61·8	64·4
18° ..	5·5	8·2	10·9	13·6	16·4	21·8	27·3	32·7	38·2	43·6	49·1	54·5	60·0	65·5	68·2
19° ..	5·8	8·6	11·5	14·4	17·3	23·0	28·8	34·5	40·3	46·1	51·8	57·6	63·3	69·1	72·0
20° ..	6·1	9·1	12·1	15·2	18·2	24·2	30·3	36·4	42·4	48·5	54·6	60·6	66·7	72·7	75·8
21° ..	6·4	9·5	12·7	15·9	19·1	25·5	31·8	38·2	44·5	50·9	57·3	63·6	70·0	76·4	79·5
22° ..	6·7	10·0	13·3	16·7	20·0	26·7	33·3	40·0	46·7	53·3	60·0	66·7	73·3	80·0	83·3
23° ..	7·0	10·5	13·9	17·4	20·9	27·9	34·8	41·8	48·8	55·8	62·7	69·7	76·7	83·6	87·1
24° ..	7·3	10·9	14·5	18·2	21·8	29·1	36·4	43·6	50·9	58·2	65·5	72·7	80·0	87·3	90·9
25° ..	7·6	11·4	15·2	19·0	22·7	30·3	37·9	45·5	53·0	60·6	68·2	75·8	83·3	90·9	94·7
26° ..	7·9	11·8	15·8	19·7	23·6	31·5	39·4	47·3	55·2	63·0	70·9	78·8	86·7	94·5	98·5
27° ..	8·2	12·3	16·4	20·5	24·5	32·7	40·9	49·1	57·3	65·5	73·6	81·8	90·0	98·2	102·3
28° ..	8·5	12·7	17·0	21·2	25·5	33·9	42·4	50·9	59·4	67·9	76·4	84·8	93·3	101·8	106·1
29° ..	8·8	13·2	17·6	22·0	26·4	35·2	43·9	52·7	61·5	70·3	79·1	87·9	96·7	105·5	109·8
30° ..	9·1	13·6	18·2	22·7	27·3	36·4	45·5	54·5	63·6	72·7	81·8	90·9	100·0	109·1	113·6
31° ..	9·4	14·1	18·8	23·5	28·2	37·6	47·0	56·4	65·8	75·2	84·5	93·9	103·3	112·7	117·4
32° ..	9·7	14·5	19·4	24·2	29·1	38·8	48·5	58·2	67·9	77·6	87·3	97·0	106·7	116·4	121·2
33° ..	10·0	15·0	20·0	25·0	30·0	40·0	50·0	60·0	70·0	80·0	90·0	100·0	110·0	120·0	125·0
34° ..	10·3	15·4	20·6	25·8	30·9	41·2	51·5	61·8	72·1	82·4	92·7	103·0	113·3	123·6	128·8
35° ..	10·6	15·9	21·2	26·5	31·8	42·4	53·0	63·6	74·2	84·8	95·5	106·1	116·7	127·3	132·6

The specific gravity of home-made lime-sulphur is invariably lower than that of the commercial solution. It is therefore advisable when using the former to first ascertain the Beaume specific gravity of the mixture, and to dilute it according to the above table. (To prepare a spray of any standard strength, first find the specific gravity of the solution by means of a Beaume hydrometer. Mark the figures in the column on the left of the chart corresponding with the reading of the hydrometer. Next select the figures in the top line representing the strength of the spray required. The figures where this column and the cross-line denoting the specific gravity of the solution intersect represent the quantity of water required to make a spray mixture of equal strength to that given at the top of the column. The table does not apply to self-boiled lime-sulphur.)

Bluestone solution—1 lb. bluestone to 15 or 20 gallons water—may be applied when the trees are dormant, in place of the first above-mentioned bordeaux spray.

Citrus-fruits, for Verrucosis, Grey-scab, &c.—Apply bordeaux, 4–4–40, or lime-sulphur, 1–50, in spring, when the main crop has set, and again in the autumn.

COMBINED SPRAYS.

Some sprays may be combined with others without detriment, and labour thus saved. Bordeaux and arsenate of lead may be applied together; also lime-sulphur and arsenate of lead; and lime-sulphur, arsenate of lead, and Black Leaf 40. It is advisable to make a heavy dilution of these ingredients before mixing them. In combining lime-sulphur with arsenate of lead, when the trees are tender it is advisable when diluting the arsenate of lead to include the milk of an equal weight of lime.

SPREADERS.

The use of spreaders in conjunction with the different sprays is a practice that is growing in popularity. It is claimed that this practice ensures instant and prolonged adhesion, an even distribution, and a better suspension of the ingredients, and that sprays which lack these qualities are greatly benefited by the inclusion of such a substance. There are several proprietary spreaders on the market, but powdered casein is claimed to serve the purpose quite satisfactorily. It may be prepared as follows: Place 5 oz. casein in a vessel and slowly add ½ gallon water, stirring well. Slowly slake 5 oz. lime and make up to ½ gallon. Pour the lime-water slowly into the casein, stirring well. Put the requisite quantity of water into the spray-tank, add the casein mixture, agitate thoroughly, then add the other ingredients. This is sufficient for 100 gallons of spray mixture.

GENERAL.

It should be recognized that owing to differences in climatic conditions and other varying factors only generalities can be dealt with in an article such as this. For this reason orchardists desirous of obtaining the best results by the most economical methods should consult the Orchard Instructor in their respective districts, the Instructor being in a position to give more specialized advice.

NOTE.—The foregoing matter has been issued as Bulletin No. 117, superseding Bulletin No. 82, "Orchard Pests and Diseases: Directions for Control."—EDITOR.

Honey-export Control Act.—The poll of honey-producers taken in December resulted in the proposal that the Act be brought into operation being carried by 253 votes to 9.

New Rabbit Districts.—The constituting of the Hunterville and Oroua Rabbit Districts (Wellington) and the Waipipi Rabbit District (Auckland), for the purposes of Part III of the Rabbit Nuisance Act, was gazetted last month.

Quarantine on Dogs.—The period of quarantine on dogs imported into New Zealand from Britain has been reduced from six months to sixty days. The amending regulation came into force on 11th December, 1924.

SEASONAL NOTES.

THE FARM.

VACANT LAND AND CATCH-CROPS.

AN all-too-common feature of many farms in the latter part of the season is the large area of stubble and other land that has grown a crop — such as early turnips, tares, &c. — and which is left idle to grow weeds and accumulate rubbish for several months, or at least till autumn grass-sowing. This is sheer waste, for February, March, and April are all good growing months in which much may be achieved. Unless the land is excessively foul — in which case a fallow is indicated — the best plan is to run the cultivator or disks through the ground once or twice to germinate weeds. In the case of twitchy land the disks should not be used, but the twitch should be worked to the surface with the cultivator and harrows. After an interval of a couple of weeks the land may be ploughed and sown as soon as the weather conditions permit.

The utilization of such vacant land depends upon the district, the requirements of the farm, and the length of time available. When grass is to be sown in March, white mustard makes cheap and easily-grown material for ploughing in; 15 lb. of seed and 2 cwt. of super should give a good crop. It is as well to remember that though mustard rots down quickly the land should be given a week or two's fallow before the grass is sown. If autumn feed is the main consideration there is still time to sow turnips — Imperial Green Globe, Hardy Green Globe, and Green-top Scotch (Aberdeen) being all suitable generally. In some northern districts swedes have been sown as late as March with success, but swedes are less adaptable than soft turnips, and less satisfactory for late sowing. Black skinless barley is another quick-growing catch-crop that will give good grazing for cows or sheep in eight weeks from sowing. In districts free from early frosts Japanese millet may be sown up to the end of January for March feeding, but not later, as it does not thrive in the shorter days and cooler nights of autumn. For later sowing and later use Algerian oats and rye-corn are both good winter grazing crops, while Western Wolths or Italian rye-grass can be sown in February for autumn or spring feed. A good mixture for average-quality land for grazing in May, and again in August and September, is—Western Wolths, 15 lb.; Italian rye-grass, 15 lb.; crimson clover, 5 lb.; red clover, 3 lb.; with super (or super and blood-and-bone), 3 cwt. This mixture is purely temporary, but will yield double the feed of permanent pasture, and that at difficult seasons of the year. For South Otago and Southland a mixture of Scotch vetches or golden tares with oats, at the rate of 1 bushel of the former and 2 bushels of the latter, is recommended for early spring feed. In Central Otago rye-corn sown at the rate of 2½ bushels will prove very useful for either lambing ewes or early calvers.

PREPARATION FOR GRASS-SOWING.

Many farmers will now be thinking of grass-sowing. In making up mixtures local conditions of soil and climate must be taken into consideration; a mixture suitable to one district often does not give satisfactory results in another. In the preparation of land (where ploughable) an early start is invaluable, as it enables the killing of weeds that would otherwise harass and weaken the young grass. Consolidation of the seed-bed is highly important; clover in particular does not strike well on loose ground. When a crop has been fed off with sheep and the land is clean it is often better to disk rather than plough, so that the treading and the manure may not be lost.

LUCERNE.

Provided the weather is seasonable, February is generally a favourable period for sowing lucerne. Compared with spring sowing, more time is available for destroying weeds, and there is less likelihood of a cold wet spell of weather following closely on the germination of the lucerne-seed and so checking the growth of the young plants. A frequent mistake in lucerne-culture is that of sowing too deeply. Sometimes one sees the ordinary tine harrows being used for this purpose, with the result that a large proportion of the seed is buried. A light brush harrow, or one made from strips of wire netting laced together and weighted at the end with bolts, will be found more satisfactory for covering the seed.

The coming month is also a good time for destroying weeds and grass which may be infesting stands of lucerne. As the lucerne is cut the land should be cultivated. If clean, a stroke of the tine harrows to keep the soil free is all that is required; but if dirty, stronger methods must be adopted. Young lucerne crops sown in November and December should be ready for cutting about the end of February, and will greatly benefit by a cultivation to keep the land free and destroy weeds. Under normal Canterbury conditions it is generally found economical to graze the last growth of established stands of lucerne. The cut is usually so light that it does not pay for working-expenses for haying. As soon as growth ceases, the land should be stirred with the grubber.

ROOT CROPS.

The intercultivation of root crops should be continued as long as possible. This operation not only keeps down weeds, but conserves moisture and aerates the soil, greatly promoting growth of the crop. Thinning of the later-sown turnip and swede crops will also call for attention at this time.

POTATOES.

In the coming month the later potato crops will be given their last cultivation. Potatoes being essentially a cleaning crop, it pays to keep the cultivator going as long as possible. Preparations may be made for saving seed. Only those tubers free from disease should be selected, and although the storage of immature seed is not always easily accomplished the latter usually gives the best results. Medium-sized seed about the size of a hen's egg will be found the most suitable generally.

—*Fields Division.*

THE ORCHARD.

EXPORT POINTS.

WHERE export is contemplated growers will do well to review the results obtained during the last season. No doubt there are many lessons to learn both in regard to the best time to gather the fruit and also in regard to the handling afterwards. Reports indicate that there is at least some room for improvement in both directions. The season will no doubt govern the picking-period. It is generally recognized that if the autumn is a dry one fruit may be left to reach a greater stage of maturity than if weather conditions are wet. This, I think, was demonstrated last season not only in regard to that portion of the fruit crop which was exported, but also to that portion of it which was placed on the local markets. Grading has also been much commented upon, and some have found that fruit is much more subject to bruising where machines are used. Although hand grading may be a little more costly, this may easily be more than compensated for by the extra price realized. How to pack fruit so that it will arrive at its destination with a minimum of bruising is no doubt a problem confronting many at this time. A little extra care and time spent when packing are well worth while. A high bulge in order to allow for subsequent shrinking is undesirable with the present New Zealand case, and from experience gained while going round the local markets this method cannot be recommended. However, a slight bulge is necessary, and is quite a good practice.

BUDDING.

This can be carried out during the next two months. The operation is a comparatively easy one, and can be successfully carried out by almost any one. The most successful and generally practised system is that known as "shield" budding. A small cross-cut is made, and the bark is raised the full length of the slit or cut to enable the bud to slip down into position easily. In preparing a bud a piece of the growing wood of the current season's growth with a well-formed bud is selected; a sharp knife is then passed from, say, ½ in. below the bud to the same distance above, taking about one-third of the wood of the shoot with the bud. If the wood is in a proper condition to bud, the wood cut with the bud can be easily pulled away from it by gently taking the bark with one hand and the wood with the other. If the interior of the bud is torn out in the process it is useless and a fresh bud must be used. No time should be lost in inserting the bud into the incision prepared for its reception, and it should then be tied round with raffia.

SPRAYING.

A lookout should still be kept for any diseases, so that a spraying as recommended previously may be carried out as required. A careful watch should be kept for leaf-roller caterpillars. The greatest damage is often done by this insect during the autumn months, and although the grub does not eat into the fruit in the same way as the codlin-moth it eats the skin and thereby causes much loss to growers. Where apples are in clusters or covered at all with leaves care should

be taken to force the arsenate-of-lead spray well into these. It is in such conditions that the chief damage is done by the caterpillar.

COVER-CROPS.

Should cover-crops be contemplated, the month of February is usually the best time in which to sow. If, as previously recommended, cultivation has been carried out very little preparation of the soil will be necessary. Peas, lupins, and vetches are among the best crops. However, if the seed of these cannot readily be obtained, mustard, oats, or barley may be sown. Where organic matter is lacking in the soil, green-manuring should not be neglected. It is recognized that this is one of the simplest and easiest ways of adding to the soil one of the chief constituents necessary for the growing of good healthy trees, also for the production of high-class fruit, and without which no orchard can be made really profitable over a long period of years.

—*L. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

The chief work for the coming month will be the carrying out of necessary cultivation and the putting on of spray compounds where necessary, according to the directions given in the December *Journal.* It is noticed that the attacks from thrip are rather greater this year than usual, and trees should be treated as already advised.

FIREBLIGHT.

It is gratifying to note that up to the time of writing no infection from fireblight has been in evidence in the commercial areas of the Auckland District, and it is reasonable to suppose that, except for the possibility of slight tip-infection somewhat later on, there is little likelihood of any other infection this season.

—*J. W. Collard, Orchard Instructor, Auckland.*

THE APIARY.

THE EXTRACTING SEASON.

By this time, provided weather conditions are favourable, extracting will be in full swing in all districts. There may be two or more extractings during the season, or the honey may be left in the hives till the close of the flow and the whole crop removed at one time. In the latter case the beekeeper needs an ample supply of supers and combs, and must watch attentively that the hives do not become honey-bound and the bees commence loafing. The better plan is to have two or three extractings during the season, removing at the first operation all combs in which the honey is wholly or three-parts sealed. When these are emptied and returned to the hives the excluders should be brought into use if they are not already in the hives.

Hot sunny weather should be chosen for the work, as on such days the honey runs freely and the bees are good-tempered. A good plan is to remove the honey in the morning, stacking the supers in

the honey-house as they are removed, preparatory to extracting in the afternoon. By this method all stray bees can be removed before the actual extracting commences, and the operator can work quickly and peacefully at emptying the combs till the evening, when the empty combs can be returned to the hives. By the morning the bees will have settled down and returned to the task of refilling. "Keep the extractor running" is a good maxim once the work has commenced, and every hot day should be utilized for gathering the harvest.

REMOVING HONEY FROM THE HIVES.

Honey should not be removed from the hives until it is well ripened. When the surfaces of the combs are a half to three-parts capped the honey is usually sufficiently ripe to enable the beekeeper to extract with perfect safety. In northern districts the practice of taking off "green honey," to be afterwards ripened in the tanks, has been to some extent carried out, but the humidity of the climate must be the deciding factor. In southern districts such procedure would be dangerous, and care should be exercised and only well-ripened honey taken. By taking unripe honey, fermentation will often result, rendering it unfit for consumption. When the time for extracting is at hand the usual practice is to remove the combs one by one, and to brush or shake off the adhering bees. As the combs are relieved of the bees they should be stacked in a super, to be afterwards removed to the honey-house. It is a wise precaution at all times to place a cloth over the combs in the super, and if there are any signs of robbing it is a good plan to use a damp cloth which has been previously immersed in water containing a small percentage of carbolic acid.

STRAINERS.

Some form of strainer should be adopted to catch the larger particles of wax, dead bees, &c., in the honey as it leaves the extractor and before it finally reaches the tank. It is a simple matter to strain the honey, and yet this important part of the work receives less attention than its importance demands. It should be the aim of every beekeeper to see that his product is rendered as marketable as possible before it finally reaches the customer, and thus create a name for a high-class article. Wax is not a component part of honey, and dead bees are foreign matter, and yet they are frequently found in honey exposed for sale. Honey containing either is not likely to suit the buyer, and its selling-value is consequently reduced. To ensure that all but the smallest particles of wax will be removed the honey should be run through a fine wire strainer, and finally passed through fine cheesecloth before entering the tank. Cheesecloth strainers are cheap and are easily made, and should be cleansed after each day's operations. The strainers should be of such construction as to be easily cleaned, and if the cloth is tacked into wooden frames the operation is greatly facilitated. Use cold water when cleansing the strainers: hot water melts the particles of wax, thereby clogging the holes in the cloth; whereas cold water removes all wax from the surface. Hang the strainers up to dry, so as to be ready for use when required.

HONEY-TANK.

No part of the apiary equipment is of more importance at extracting-time than a good tank. From the strainers in use it is

advantageous to run the honey into a tank, so that the small particles of wax that pass through the strainers will rise to the surface, when they can be skimmed off before finally drawing the honey off at the bottom of the tank. Many beekeepers run their honey direct from the strainers into tins and small packages ready for sale, with the result that the small particles of wax rise to the surface, to the detriment of the honey and its sale. Frequently complaints are made as to the quality of the honey, and not infrequently adulteration is suspected through an excess of these wax-particles rising to the surface. Such honey should not find its way to market, its condition having been brought about by sheer neglect on the part of the beekeeper to provide adequate tank accommodation. By allowing the honey to settle in the tank the air-bubbles escape, the small particles of wax rise to the surface, and in dry weather surplus water is evaporated. The size of the tank to be adopted must be decided by the beekeeper himself, as it is hard to find two beekeepers with requirements alike in the matter of honey-tanks. He must study his needs and convenience, but in any case the tank should hold enough to enable him to deal with the honey in the hives at the time of extracting. The tank illustrated in Bulletin No. 55, "Bee-culture," in use at the Department's experimental apiary, is capable of dealing with the product of two hundred colonies, and is so arranged that each extracting can be left undisturbed until it is matured and ready to be run off into the tins.

CLEANLINESS IN THE HONEY-HOUSE.

It should hardly be necessary to point out that the greatest care must be taken in preparing honey for market. However, it is by no means an uncommon thing to come across cases where the beekeeper appears to have lost sight of the fact that honey is a food, and, what is of more importance, a food which is eaten uncooked. Too much stress cannot be laid on the fact that everything in the honey-house should receive the same attention as dairy utensils. The extractor and tank cannot be washed out every day during the season, but they should be thoroughly scalded before commencing operations, and whenever honey is allowed to remain in them they should be covered with clean washing covers. These cost little, are easily made, and should be very much in evidence throughout the season. On no account should bees, flies, dust, or other foreign matter be allowed to alight on the honey in the tank, and as soon as extracting is finished for the day the extractor should be closely covered with a cloth. Finally, as a fitting close to the day's work, the floor of the extracting-room should be washed and every drop of honey spilt during the day removed.

TREATMENT OF FOUL-BROOD.

The work of putting colonies under treatment where foul-brood is detected should not be postponed. The season is a short one, and every effort should be made to winter only clean hives. The risk of having the disease spread by robbing during the off-season, when it is most likely to break out, will lead to endless work in the spring unless the beekeeper is in earnest in checking its spread during favourable conditions. No better plan can be followed than to treat all infected colonies by the McEvoy method during the late

flow. Many beekeepers are too ready to postpone treatment, only to find in the spring their hives weak in bees, and consequently in poor condition for successful treatment. No half-measures should be adopted when dealing with foul-brood, and in all cases the "double shake" should be practised if the disease is to be entirely eradicated. A good plan to follow if any doubt exists as to the complete absence of the disease is to mark all infected colonies, and to leave them to be finally dealt with after the clean colonies are extracted. In any case the combs should be marked with the number of the hive to which they belong, so that when they are extracted they may be returned to the colony from which they were taken. If these precautions are taken the risk of spreading disease by means of wet combs is minimized.

—*E. A. Earp, Senior Apiary Instructor.*

POULTRY-KEEPING.

CARE OF THE PULLETS: PRECAUTIONS AGAINST COLDS.

Now that the great majority of the young stock will have attained an age when they do not require constant attention an opportunity is provided for getting the plant in good order for the winter season. Every care should be taken to make the houses where the young pullets are to be placed later fit to receive them, so that they will not have any setback. The houses should be thoroughly cleaned, sprayed with a good disinfectant, and otherwise made as sweet and comfortable as possible. Not only should they be free from vermin, but special attention should also be taken to prevent in every possible way the young birds from catching colds—the common ailment when cold autumn snaps are experienced.

It should hardly require emphasizing that in handling artificially reared chickens, which have been brought up under practically hot-house conditions, special care must be taken with them throughout all stages of their development. It is safe to say that thousands of pullets every season are either lost or fail to lay when expected by reason of colds due to improper treatment on the part of their owners. The great weakness in this connection is that the average poultry-keeper gives too much consideration to the question of curing colds rather than to preventing them. As with other troubles affecting poultry, prevention is more satisfactory than treatment. If colds are to be avoided it is imperative that the pullets be protected from extremes of weather. A necessary factor is that the house be roomy, so that the birds can be fed inside in wet weather and fed early in the evening, so that they will not be moping about with wet plumage, waiting for their evening meal thrown down in a muddy yard.

Where colds have given trouble in the past the poultry-keeper must straightway take several measures if they are to be avoided in the future. He must first of all study his local conditions. Having proper housing designed on the deep open-fronted system, the next important point is to see that the houses are free from draughts and that the birds roost in comfort. This implies no cracks in the side or back walls allowing a draught of air between the opening in the front of the house

and the walls. Too often poultry-keepers take no notice of a few cracks in the partitions dividing the houses. This is a mistake, as colds can often be traced to neglect in this way. Unless the intersecting walls are draught-proof they should be made so with some airtight material, such as cheap roofing-material, &c.

The deep lean-to house with front partly open is now generally adopted, and rightly so, but the question of how much of the front of the house should be left open to provide ventilation is a matter that can be decided only according to the prevailing local conditions. Generally a space of 3 ft. is allowed, but experience goes to prove that where the plant is located on a bleak situation this amount of space must be reduced if colds are to be prevented. Especially does this apply where the perches are placed high above the floor. Some people go so far as to have an opening in both the front and back walls as a means of providing plenty of ventilation. Unless, however, the site is a well-sheltered one and mild climatic conditions prevail, colds are almost sure to appear where young stock are concerned. Good ventilation is an essential requirement for feathered stock of all ages, but it can be easily overdone with the artificially produced young pullet. It is a mistake to conclude that because adult birds keep free from colds in an overventilated or draughty house the growing pullet will do likewise. This does not mean that the pullets should be coddled, but rather that they should be intelligently handled. For instance, poorly ventilated quarters should be always guarded against, as in these the birds become overheated by night, making them susceptible to chill when they go out of doors in the morning. Then, again, in order to resist colds the pullets must not be overcrowded. Above all things, they must be kept in good condition by proper feeding and general common-sense management.

The first symptom of colds is sneezing, with a watery discharge from the nostrils and eyes. Colds are the forerunner of roup. If the breath becomes offensive, and a swelling or a cheese-like substance protrudes from the eye, it indicates that the cold has developed into roup. A cold may be treated successfully, but once the roup stage has been reached it will usually pay to destroy the bird at once rather than attempt to doctor it. With colds and roup the best advice is to prevent them, but if the birds become affected the cause should be sought and at once remedied. A simple method of treatment is to take a shallow dish, fill it with pure kerosene, and dip the bird's beak in this sufficiently deep to cover the nostrils. Hold the bird in this position until it breathes. This will have the effect of drawing the kerosene to the seat of the trouble. Repeat the treatment on alternate days until a cure is effected. In applying this treatment care must be taken to prevent the kerosene from getting on to the face of the bird, as it is apt to have an injurious effect. The nostrils should be covered and no more, while the dipped parts should be wiped with a dry cloth after each operation.

I would again emphasize that the aim of the poultry-keeper should be to prevent even a slight cold from making its appearance, by removing all sources favourable to its development. It should be remembered that the curing of colds involves considerable labour, and that even when a cure is effected the trouble is likely to recur at any time unless the cause is removed.

MARKING CHICKENS.

Poultry-keepers should on no account fail to mark the young stock as a future guide to age. A punch for the purpose, together with instructions as to its use, can be obtained at a moderate cost. Few people can accurately judge the age of fowls, and if there is no mark as an indication to age many of the current season's pullets are apt to be culled in the following year, while old and unprofitable ones may be retained on the plant. As the great majority of birds prove unprofitable to keep after their second laying season, the marking of young birds without delay is a matter that should appeal to the poultry-keeper who is really anxious to secure a maximum of profit from his flock. The best time of the year to cull is when the birds are taking a rest previous to moulting.

FORCING THE MOULT.

A correspondent asks if it would be a wise course to induce his birds to rest and moult now, with the hope of their laying better in the winter months. I cannot recommend this. For winter-egg production no doubt the pullet is the most desirable bird. The only safe course from the time when a pullet reaches maturity is to force every egg from her until her season is completed, irrespective of season and the price of eggs. Of course, an exception should be made with birds intended for future breeding purposes or those that are being bred from.

—*F. C. Brown, Chief Poultry Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

THE planting of the winter crops—savoy, cabbage, broccoli, celery, and leeks—should be completed as soon as possible. Where they are well established steady growth should be induced by regular hoeing and cultivation. Sometime during showery weather a dressing of nitrate of soda may be applied with benefit. If the weather is at all dry the celery trenches must not be allowed to suffer; similar treatment is required for the asparagus and rhubarb beds. All these crops should be induced to make strong steady growth during the autumn. Potato and onion crops should be harvested as soon as they ripen. Nothing is gained by allowing them to remain in the ground, as they sometimes do, and very great risks are run from second growth and disease. Spinach forms a popular and wholesome dish, and helps to provide that variety which is so desirable. A good sowing now will make rapid growth and afford early supplies. Towards the end of winter, vegetable-supplies begin to get short and the roots in store lose condition. It is then one looks forward to fresh spring cabbage and good salads. To secure these, lettuce and cabbage of an early variety should be sown towards the end of February, or rather earlier in southern districts. A piece of good land in a warm well-drained position on which to put out the plants can be prepared. The sowing of the early large white onion crop is best deferred for the present.

TOMATOES.

The tomato crop under glass should be freely ventilated. Remove the leaves below the ripening bunch and give liquid manure fortnightly. When the harvesting of this crop is completed, dig up the roots carefully and leave the plants hanging on the strings for a while till dry, when they should be removed and burnt. Clean up the house thoroughly by spraying or fumigating, and freely ventilate it. Broadcast a green crop—white mustard is popular at this season—and plough the seed in lightly with a small hand-plough.

The tomato crop outside will now be ripening, and packing and selling the fruit will be keeping growers busy. The public do not make the full use of tomatoes that they should. Many delicacies can be made from this fruit—sauces, purees, chutneys, and pastes—that are wholesome, tasty, and useful during winter. It is somebody's business to remind the busy public when tomatoes are in season, and educate them on their many and excellent uses. It is just as important to sell the fruit as to grow it.

THE BERRY CROPS.

Cultivation of the berry crops should be continued. Inspecting an area in gooseberries recently many that had been fine big plants were found to be dead. Lifting and examining two or three it was discovered that there were a number of severe horizontal cuts in the butts of the bushes, evidently made when hoeing. Cultivation among these crops requires to be done in a sympathetic as well as a thorough manner. The nicest consideration is necessary in order to obtain good results. All necessary spraying should be attended to. These crops need replanting from time to time, and such planting now requires careful consideration. The plants should be ordered early, and the ground carefully prepared, special care being taken to clean it of weeds—for strawberries more particularly. A dressing of superphosphate, and a green crop sown now to plough in later, would be an excellent preliminary preparation in many cases.

TOBACCO.

Tobacco-growers will now be busy harvesting and curing the crop. It must be remembered that this product is very responsive to treatment, and what are apparently details have very great results in the quality of the final product. For this reason the habit of close observation and attention to detail must be cultivated by those who wish to continue growing this plant successfully. The curing process must be regulated by the proper control of ventilators—opening them in damp weather and closing them when the weather conditions are dry, or reversely, just as it is desired to hasten or retard the curing process. This process should finally leave the plant-stalks and leaf-stems well dried out, a development usually taking six or eight weeks to accomplish under the air-curing system.

THE COUNTRY-HOME GARDEN.

The country home for its pleasure, convenience, and comfort depends very largely on the garden. If that is non-existent, or

practically so, a very important influence is lost. The furnishing of the interior of the home receives careful consideration, but our genial climate affords us every inducement and opportunity to enjoy the pleasures and conveniences of that outward adornment that can only be obtained at great expense in less favoured lands. The essential features of a satisfactory country garden need not occasion great expense or a large amount of work, although, of course, there are endless possibilities for those who take a special pleasure in it. Too often the ideals of many run in the direction of a flower-garden only, and one which contains a large collection of plants, and sometimes gives far more work than pleasure in its maintenance. An effective country-home garden should harmonize with the locality. It should surround the homestead, and include effective and ornamental shelter and shade, a reasonable amount of lawn of dwarf grasses, and paths well formed, graded, and metalled, but not in excess of those actually needed and used. The flower-garden feature is best kept to quite modest dimensions and variety, unless the household includes one or two enthusiasts in this direction. Shrubs, trees and palms, and bulbs growing in the grass supply in an easy way the main floral and decorative features for the majority.

The subject is referred to here as we are now approaching the season of the year for making or remodelling the garden—the autumn. To carry out the idea not so much money or work is required as consideration. The subject requires a great deal of careful thought, so that the best may be made of the circumstances, and that trees and shrubs naturally suited to the locality and purpose be selected and tastefully arranged. The short planting season commences towards the end of May, and by that time it is best to have any work of this kind completed and ready for the planting.

—*W. C. Hyde, Horticulturist.*

SOME C.O.R. JERSEYS IN TARANAKI.

EXPORT OF APPLES, 1925 SEASON.

I. CONDITIONS OF GOVERNMENT GUARANTEE.

CONDITIONS for the Government guarantee of 1d. per pound net return on shipments of apples made from New Zealand during the 1925 export season are as follows :—

1. The guarantee shall be limited to approved varieties and classes of fruit packed in compliance with the requirements of the "Extra Fancy" or "Fancy" grades, and shall be restricted to a maximum of 300,000 cases.

2. The Government's liability under the guarantee shall include all packing and marketing expenses which the Department of Agriculture may deem reasonable and necessary, plus 3s. 4d. per case. No allowance to be made for cool storage unless an approved system of precooling is adopted, in which event such allowance shall not exceed 5d. per case; and, further, the insurance allowance shall not exceed that required to provide an ordinary marine-risk cover. In case of shipments to the United Kingdom no charge for selling-commission exceeding 5 per cent. will be allowed, nor will a total exceeding 1s. per case be allowed for the following overseas charges—namely, supervision, port rates, dock charges, warehousing, cartage, tolls, porterage, forwarding, and surcharges.

3. The guarantee to be limited to fruit grown and shipped (otherwise than under a f.o.b. contract) by *bona fide* fruitgrowers or fruitgrowers' co-operative societies, through channels recommended to the Minister of Agriculture by the Fruit-export Control Board, and approved by him.

4. Any grower who exports any portion of his "Extra Fancy" or "Fancy" grade fruit crop outside the guarantee shall be deemed to have forfeited his right to participate in the guarantee with respect to all fruit exported during the season by him or on his behalf.

5. All fruit to qualify for the guarantee must be passed by an Inspector of the Department, and must be packed in accordance with the Export Regulations, subject to the modifications and directions set out in the appended statement entitled "Export Regulations."

6. Payment of claims under the guarantee shall be calculated on the basis of the average price received by the claimant for the whole of the "Extra Fancy" and "Fancy" grade fruit exported (otherwise than under a f.o.b. contract) on his account during the season, irrespective of markets.

7. Where, however, fruit of more than one variety and supplied by more than one grower is exported by a joint packing company or group in its own name the guarantee shall be calculated separately in respect of the whole of the fruit supplied for export by each grower, on the basis of the pool price received for each variety supplied by him with respect to each shipment; provided that the joint packing company or group shall have, not later than seven days after the fruit has been shipped from New Zealand, notified to the Director of the Horticulture Division full particulars of each grower's fruit included in each shipment.

8. The Government reserves to itself the right (*a*) to limit the quantity of fruit shipped to any particular port should freight rates or market conditions, &c., be deemed unsatisfactory; (*b*) to insist on all fruit being precooled prior to shipment, if deemed necessary; (*c*) to withhold the privileges of the guarantee from all fruit shipped in vessels the storage facilities of which are held by the Department to be unsatisfactory; (*d*) to withhold the privileges of the guarantee with respect to any market in connection with which the Fruit-export Control Board are of the opinion a satisfactory f.o.b. or c.i.f. trade is or can be established.

9. The Government reserves the right to re-examine and to withdraw any fruit from export in the event of such re-examination indicating that by reason of overmaturity or other cause inimical to the keeping-qualities of the fruit it would be inadvisable to allow such fruit to be exported. All fruit so withdrawn may be disposed of in New Zealand by the owner without reference to the guarantee, or by the Government on behalf of the owner. In the latter event the proceeds will be credited to the owner, and the transaction dealt with generally as though the fruit had been actually exported under the guarantee. But should such re-examination reveal the fact that any line of fruit, through careless or faulty packing, is decidedly below the standard required it will be deemed not to be covered by the guarantee, and the owner of such fruit may, at the option of the Minister, be held to have forfeited all right to participate in the guarantee for the remainder of the season.

2. EXPORT REGULATIONS.

The following regulations shall apply to all apples intended for export under the Government guarantee, 1925:—

GRADES AND VARIETIES.

"EXTRA FANCY" AND "FANCY" GRADES.

The standards shall be as set out in the Export Regulations of 1920, the principal requirements of which are as follows:—

Grade.	Colour.				Defects.
	Solid Red.	Partial Red.	Striped.	Yellow or Green.	
	Per Cent.	Per Cent.	Per Cent.		
Extra fancy	75	50	$33\frac{1}{3}$	Good characteristic colour	No more than 8 per cent. of apples in case affected with slight blemish.
Fancy ..	50	25	20	Good characteristic colour	Apples not to be affected with more than 5 per cent. blemish or 5 per cent. unnatural russet.

Ten per cent. and 5 per cent. reduction in the above-mentioned colour requirements with respect to "Extra Fancy" and "Fancy" grades will be allowed in connection with fruit packed for European markets.

VARIETIES.

The following varieties of apples (which were accepted for export in the 1923 season), owing to their unsatisfactory carriage and out-turn, and the low prices realized in consequence of this or other unsuitable marketing characteristics, have been omitted from the 1925 export list: Alfriston, Ballarat, Reinette du Canada, Washington.

The following have been omitted mainly on account of there being an insufficient quantity offering to warrant retention: Sharp's Late Red, Claygate Pearmain, Golden Russet, Scarlet Pearmain, Shepherd's Perfection.

The varieties marked with an asterisk in the following lists, although retained, are considered to be of little value for export purposes, and growers are advised to consider the reworking of these varieties, as well as those above mentioned, with a more suitable export variety, such as Delicious. In the case of London Pippin the fruit must be hand graded and sized, and specially good of the variety.

Approved for Export to Europe.

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
	Solid Red Varieties.				
96	Baldwin*	225	110	Rokewood	240
96	Hoover*	225	96	Tasma	225
	Partial Red Varieties.				
110	Crofton	225	110	Scarlet Nonpareil ..	240
96	Delicious	225	110	Shorland Queen ..	225
110	Dougherty	255	96	Spitzenberg	225
110	John Sharp ..	225	110	Stark	225
110	Jonathan	240	110	Wagner	225
110	King David ..	240	110	Worcester Pearmain ..	225
96	Rome Beauty ..	225	110	Yates	255

Approved for Export to Europe—continued.

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
	Striped Varieties.				
110	Adams Pearmain ..	225	120	Ribston Pippin ..	225
110	Allington Pippin* ..	225	110	Senator	225
120	Cox's Orange ..	255	110	Statesman	240
96	Premier	210	110	Stayman Winesap ..	210
	Yellow or Green Varieties.				
96	Boston Russet ..	225	96	London Pippin* ..	200
110	Brownlee's Russet ..	225	96	McMahon's White ..	225
110	Cleopatra	240	110	Newtown Pippin ..	240
96	Dunn's	210	96	Parlin's Beauty* ..	225
110	Golden Pippin ..	225	110	Sturmer	240
110	Grannie Smith ..	225	110	Willie Sharp ..	225
110	Gravenstein ..	225			

Approved for Export to South America.

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
	Solid Red Varieties.				
80	Baldwin	140	96	Rokewood	140
80	Hoover	140	64	Tasma	140
	Partial Red Varieties.				
96	Crofton	140	80	Scarlet Nonpareil ..	140
80	Delicious	140	80	Shepherd's Perfection	140
80	Dougherty	140	96	Shorland Queen ..	140
96	Jonathan	140	80	Spitzenberg	140
96	John Sharp ..	140	96	Stark	140
96	King David ..	140	96	Wagner	140
80	Rome Beauty ..	140	110	Yates	140
80	Salome	140			
	Striped Varieties.				
96	Adams Pearmain ..	140	80	Senator	140
80	Australian Dougherty	140	96	Statesman	140
80	Premier	140	80	Stayman Winesap ..	140
	Yellow or Green Varieties.				
96	Cleopatra	140	96	Sturmer	140
80	Dunn's	140			

SPECIAL CONDITIONS APPLYING TO EXPORT TO SOUTH AMERICA.

The modifications regarding colour standards allowed for European markets will not apply to apples for the South American market.

Grades: No fruit below the standard of "Fancy" grade as defined in the Export Regulations to be exported to South America.

"GOOD" GRADE.

Fruit packed in accordance with the requirements of "Good" grade may be exported to European markets only. The standard of the grade shall be as provided by the 1924 export conditions, the principal of which are :—

Grade.	Colour.				Defects.
	Solid Red.	Partial Red.	Striped.	Yellow or Green.	
	Per Cent.	Per Cent.	Per Cent.		
Good ..	30	15	10	Good characteristic colour	5 per cent. blemish or 15 per cent. unnatural russet.

The varieties for export under this grade shall be as set out in the European export list, excepting that the minimum size of any variety shall be not less than 210 apples per case, other than Cleopatra, Dougherty, Jonathan, King David, Sturmer, and Yates, the minimum size of which shall not be less than 225, and Cox's Orange 240 per case.

REGISTERED EXPORT NUMBER.

The registered number issued to all growers under the Local Market Regulations will be declared to be the grower's registered export number also. The registered number of each grower must be branded on each case of fruit exported by him.

In respect to fruit packed by a packing organization to which a registered number has been allotted, such consignments may be marked with the registered number of the packing association only, provided that each grower's fruit is shown separately on the advice-note for examination, and stacked in separate lots, so that the Inspector may have no difficulty in determining which is the particular lot under examination. For example, a line of 100 cases of Cox's Orange coming from two different growers would be submitted as follows :—

Shipping-mark.	Registered Export Brand.	Total Number of Cases.	Variety.	Grade.	Number of Cases.	Pack.
345	P607	60	Cox's Orange ..	Fancy ..	14	163
			" ..	" ..	14	175
			" ..	" ..	8	188
			" ..	" ..	12	210
			" ..	" ..	12	225
345	P607	40	Cox's Orange ..	Fancy ..	8	163
			" ..	" ..	5	175
			" ..	" ..	7	188
			" ..	" ..	9	210
			" ..	" ..	11	225

These would be stacked separately in two lots, and examined as different lines.

Should unavoidable circumstances prevent the adoption of this procedure, resulting in a line comprising a larger number of cases being submitted as one line, it must be definitely understood that the examination of same will be solely at the grower's risk, and in the event of any fruit forming a portion of the line being found to be unsatisfactory the whole line will be liable to rejection.

LABELLING AND MARKING.

A coloured label corresponding with that used in the 1924 season has been approved for use in connection with "Extra Fancy" and "Fancy" grade fruit. A non-coloured label of similar design has been approved in connection with "Good" grade fruit. All cases of fruit intended for export must bear a label on each end according to grade, as above indicated.

The marking of cases shall be in accordance with the 1924 season's requirements.

LABELS FOR TRAYS.

Special labels for use on apple and pear trays have been prepared, and will be procurable from the New Zealand Fruitgrowers' Federation.

WRAPPING-PAPER.

Apples of the various sizes as set out below shall be wrapped in paper of the size indicated opposite each respectively :—

Sizes 64's to 80's (both inclusive), paper 11 in. by 11 in.
Sizes 88's to 110's (both inclusive), paper 10 in. by 10 in.
Sizes 120's to 200's (both inclusive), paper 9 in. by 9 in.
Sizes 210's to 240's (both inclusive), paper 8 in. by 8 in.

In the event of the size of the paper used being smaller than that specified above for any respective size of apples, such apples shall be double-wrapped by overlapping two papers.

SPECIFICATIONS OF EXPORT CASE.

The timber recommended for the construction of an export fruit-case is white-pine of good quality, but *Pinus insignis*, rimu, and beech timber, if well and evenly cut, will be accepted. Owing to the unsatisfactory nature of cases constructed of poplar timber, cases of this class will not be approved for export.

The inside measurements of the export bushel case shall be 10 in. by 11¼ in. by 19¾ in.

Sizes of timber: The ends shall be made of boards of the following size—10 in. by 11¼ in. by ¾ in.; one-piece board at each end; both end boards to be planed on the outer side. The sides shall be made of boards of the following size—10 in. by 21¼ in. by $\frac{5}{16}$ in.; one or two boards optional for each side, provided that no side board shall be less than 4½ in. in width. The tops and bottoms shall be made of boards of the following size—11 in. by 21¼ in. by $\frac{5}{16}$ in.; one or two boards optional, provided that no board used for the purpose is less than 5 in. in width. Provided that tops and bottoms may be made of boards of the following size—11 in. by 21¼ in. by $\frac{3}{16}$ in., to be used with the addition of four cleats per case, measuring 11 in. by 1 in. by $\frac{5}{16}$ in.

In the event of two-piece sides being used in the construction of the case above referred to, the space between the boards shall not exceed ¼ in. In the event of two-piece tops and bottoms being used the space between such boards shall not exceed ½ in.

Nailing: Nails used to be not less than 1½ in. long, 14 gauge. Nails to be spaced not more than 3 in. apart, and the outer nails of each board to be not more than 1 in. from the edge of board.

Strapping: All cases to be strapped with a wire or steel band, such strapping to be tightly applied and to be not more than 1 in. from end of case.

CONSTRUCTION OF TRAYS.

Selected apples and pears may be exported—the former under the guarantee—in wooden trays having an inside measurement of 11¼ in. by 19¾ in., with depth from 2½ in. to 3 in. Each tray to be complete with lid and label. Three trays to be securely wired together, forming one package. Binding-wires to be placed within 1 in. of each end of the package. Timber for the construction of trays to conform in thickness to that prescribed for the standard apple-case.

CASES AND PACKING.

Specifications of the standard export case shall be strictly observed.

Corrugated strawboard or wood-wool shall be used on top and bottom of cases. All large fruit to be double-wrapped unless paper of sufficient size is used.

MINIMUM CONSIGNMENT.

Twenty cases of any one variety shall be the minimum consignment accepted for export.

WEATHER RECORDS: DECEMBER AND CALENDAR YEAR 1924.

Dominion Meteorological Office.

GENERAL SUMMARY FOR DECEMBER.

Dull, mild, and humid conditions were features of December weather, and were associated with some heavy rainfalls, especially in the North Island and north-eastern parts of the South Island, owing to a succession of ex-tropical disturbances passing in and northward of Cook Strait.

Returns to hand show heaviest rainfalls in the Wairarapa: Masterton had a total of 13·28 in., which is 417 per cent. of the average; and Greytown recorded 12·54 in. Mangahao, the water-power centre for Wellington District, had 14·36 in.; Wellington 11·39 in., which is 256 per cent. of the average; and Wainuiomata, the main water-supply for the city, recorded 23·12 in. The only parts of the country so far showing they had less than the average December falls are around Hokitika, Greymouth, Queenstown, and Clyde. Parts of Central Otago and South Canterbury report more wet weather than usual. Pleasant Point, twelve miles inland from Timaru, recorded 8·33 in.—the heaviest monthly fall at that station in twenty-one years. Otautau (Southland), however, reports a fine, dry month, with a total of 3·73 in.

Summer electrical conditions were prevalent, and thunderstorms were reported, chiefly about the 5th, 7th, and 22nd.

Barometric changes were common, but the fluctuations of pressure were more frequent than phenomenal, though the means for the month were everywhere considerably below the average.

—*D. C. Bates, Director.*

RAINFALL FOR DECEMBER AND CALENDAR YEAR 1924 AT REPRESENTATIVE STATIONS.

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1924.	Average Rainfall.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches
Kaitaia	5·56	14	1·82	3·28	76·72	50·87
Russell	4·94	10	2·28	2·05	57·01	48·85
Whangarei	6·12	11	2·00	2·49	73·76	60·24
Auckland	4·41	18	1·25	2·86	66·66	44·20
Hamilton	8·06	24	2·17	3·68	65·53	49·72
Kawhia	6·56	18	1·48	3·21	62·96	52·70
New Plymouth ..	9·60	21	1·94	4·28	72·22	59·95
Inglewood	11·58	21	2·34	7·43	117·23	104·45
Whangamomona ..	8·56	18	2·25	5·98	90·18	80·15
Tairua, Thames ..	7·98	14	3·20	4·30	95·88	65·82
Tauranga	8·87	18	3·56	3·35	62·58	51·95
Maraehako, Opotiki ..	4·00	7	1·08	2·82	71·23	50·77
Gisborne	2·28	11	0·52	2·13	53·42	46·96
Taupo	5·70	13	1·60	3·66	55·59	45·20
Napier	2·30	12	0·49	2·04	36·72	36·56
Maraekakaho, Hastings	4·75	19	0·96	2·21	36·85	34·77
Taihape	5·37	17	1·16	3·43	45·90	40·18
Masterton	13·28	15	7·06	2·57	48·89	38·71
Patea	9·40	20	2·54	3·35	60·37	44·05
Wanganui	5·18	11	0·93	2·63	38·81	36·86
Foxton	7·61	..	1·83	2·15	38·76	31·43
Wellington	11·39	16	2·74	3·20	49·21	48·09

RAINFALL FOR DECEMBER AND CALENDAR YEAR 1924—*continued.*

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1924.	Average Rainfall.
			South Island.			
Westport	6·73	23	1·83	6·60	82·24	78·31
Greymouth	7·31	17	0·96	8·95	96·50	104·13
Hokitika	9·49	20	1·75	10·60	133·78	116·53
Arthur's Pass	8·92	18	1·14	12·02	162·81	147·11
Okuru, Westland ..	8·62	12	1·68	11·73	171·37	148·32
Collingwood	8·15	14	2·10	8·01	101·64	99·81
Nelson	6·83	16	1·38	2·67	53·94	37·60
Spring Creek, Blenheim	4·19	14	1·12	1·93	33·81	30·12
Tophouse	7·99	18	2·14	5·00	69·22	60·78
Hanmer Springs ..	11·00	19	1·70	2·89	50·31	39·11
Highfield, Waiau ..	6·60	17	1·28	2·51	34·13	33·38
Gore Bay	5·55	17	0·96	2·12	31·87	31·63
Christchurch	3·94	18	0·91	2·03	25·33	25·00
Timaru	4·72	16	0·98	2·38	19·54	23·15
Lambrook, Fairlie ..	7·28	12	2·16	2·33	26·51	25·09
Benmore, Omarama ..	3·74	20	1·08	1·77	29·74	24·15
Oamaru	..	..	..	2·06	..	22·03
Queenstown	1·98	13	0·51	2·55	35·65	30·39
Clyde	1·54	8	0·74	1·79	17·79	15·03
Dunedin	..	..	..	3·50	..	36·85
Gore	..	..	..	3·36	..	35·17
Invercargill	4·66	19	0·86	4·34	36·73	46·48

FORTHCOMING AGRICULTURAL SHOWS.

Tapanui Farmers' Club: Jubilee Show, Tapanui, 28th January.
Pahiatua A. and P. Association: Pahiatua, 30th January.
Maniototo A. and P. Association: Ranfurly, 6th February.
Clevedon A. and P. Association: Clevedon, 7th February.
Dannevirke A. and P. Association: Dannevirke, 11th and 12th February.
Te Puke A. and P. Association: Te Puke, 12th February.
Rodney Agricultural Society: Warkworth, 14th February.
Northern Wairoa A. and P. Association: Mititai, 17th and 18th February.
Masterton A. and P. Association: Solway, 17th and 18th February.
Te Awamutu A., P., and H. Association: Te Awamutu, 18th February.
Whakatane A. and P. Association: Taneatua, 18th February.
West Coast A. and P. Association: Greymouth, 18th and 19th February.
Rotorua A. and P. Association: Rotorua, 20th February.
Buller A. and P. Association: Westport, 20th and 21st February.
Waiapu P. and I. Association: Ruatorea, 25th and 26th February.
North Kaipara Agricultural Association: Paparoa, 26th February.
Tauranga A. and P. Association: Tauranga, 26th February.
Opotiki A. and P. Association: Opotiki, 26th February.
Franklin A. and P. Association: Pukekohe, 27th and 28th February.
Omaha and Pakiri A. and H. Association: Leigh, 28th February.
Taumarunui A. and P. Association: Taumarunui, 4th March.
Waikato Central A. Association: Cambridge, 4th and 5th March.
Mangonui A. and P. Association: Mangonui, 6th and 7th March.
Morrinsville A., P., and H. Society: Morrinsville, 11th March.
King-country Central A. and P. Association: Te Kuiti, 12th March.
Matamata A. and P. Association: Matamata, 19th March.
Mayfield A. and P. Association: Mayfield, 21st March.
Methven A. and P. Association: Methven, 26th March
Temuka and Geraldine A. and P. Association: Winchester, 2nd April

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CHICKWEED AND SHEEP.

N. TILLEY, Takapau :—

I lost three ewes recently, and am somewhat puzzled as to the cause of death. In each case the ewe was in good condition and the mother of a thriving well-grown lamb. They were running on good pasture, mostly cocksfoot and dogstail. My theory is that the favourable growing-weather during the spring encouraged some weed to grow that is fatal to sheep if eaten. The enclosed weed is very prevalent this season : is it harmful ?

The Live-stock Division :—

The weed specimen you forwarded has been identified as mouse-eared chickweed (*Cerastium vulgatum*), a close ally of the common chickweed. According to certain authorities the chickweeds cause disorder to the digestive system when eaten in large quantities, but a definite opinion could not be given in your case without further investigation.

CONTROL OF VARIEGATED AND WING THISTLES.

G. F. BAYLY, Turakina :—

On my property in the Turakina Valley a quantity of variegated and wing thistles have yearly made their appearance on the tops of ridges and in sheep-camps. This year they are exceptionally bad. It has been the practice of farmers generally to cut the variegated thistle and leave the wing thistle untouched, but I find that where the variegated thistles have been cut earlier in the spring the wing thistles have come considerably thicker. Is the only method of eradicating this pest to cut them ? As mentioned, the thistles practically appear only on the very tops of the ridges, suggesting that the ground may be deficient in some plant-food, yet not sufficiently deficient to prevent the thistles appearing. Is there any manure that would help bring back the grass, and thus perhaps smother out the weeds ?

The Fields Division :—

Both variegated and wing thistles are found chiefly on country that is broken by the tramping of stock or similar means, this providing a good seed-bed. Sheep-camps and gateways are particularly bad. The past season in your district being wetter than usual, the land was considerably poached; consequently thistles are very bad this year. Variegated thistles cover a considerable area of ground, and for the time being control the growth of grass ; then, the cutting disturbs the soil to some extent, and this further increases the area that is suitable as a seed-bed for the wing thistle, and the latter gets away before grass is re-established. Both these thistles may be controlled by spraying with a good weed-destroyer or an arsenical preparation, but this is expensive, and generally cutting is considered the cheapest and most effective method. The fact that thistles grow well on certain parts indicates that the land is well provided with plant-food, and most crops should do well after them. Top-dressing with a good phosphatic manure like basic super or super and lime would greatly strengthen the pasture and help to crowd out the thistles.

REMOVING BEES FROM WALL OF HOUSE.

M. C., Dannevirke :—

Bees have taken possession of the inner wall of a bedroom, much to the annoyance of the occupant. Will you kindly inform me how to dislodge them with safety to an operator who is totally ignorant of their habits ?

The Horticulture Division :—

The quickest plan to adopt is to strip the boards on the inner wall of the building so as to expose the combs. If the services of a beekeeper are not available bees can be successfully removed by proceeding as follows: Take a bee-smoker and charge it with dry sacking, so that when lighted the smoke can be forced in at the entrances which the bees are using. Usually a few puffs of dense smoke will drive the bees to the honey, and they can then be handled without much risk of the operator getting stung. The weatherboards or other material can then be removed, the bees brushed into a box, and the combs removed. After the operation is complete block up all entrances, so as to prevent further swarms from taking possession; and if the inside woodwork is smeared with carbolic acid or a pungent chemical this will act as a deterrent to bees again entering the building. If the operator is nervous a veil should be worn.

RABBIT-POISON AND ROAD-LINES.

"COCKY," Feilding :—

Please let me know whether poison can be laid for rabbits closer to a public road than 2 chains.

The Live-stock Division :—

Rabbit-poison may be laid right up to the road-line. Every precaution should, of course, be taken to prevent the possibility of accident (especially when strychnine is used) by giving or posting of notices. Section 15 of the Police Offences Act provides that poison shall not be laid on or within 3 chains of any highway outside of any borough or town district. This provision, however, does not apply in the case of poison laid for the destruction of rabbits. If you desire a ruling on a definite case it is recommended that you consult a solicitor, as the matter may be governed by special circumstances.

PRE-MIXING OF FERTILIZERS.

PALMER BROS., Whangamata :—

We expect to be top-dressing about 350 acres of hill country this coming autumn with a 50-50 mixture of super and Nauru, plus 1 cwt. or so of sulphate of potash per ton. Would you kindly inform us whether there would be any disadvantage in having the manure mixed at the works, assuming that some of it may not be spread for four or five weeks?

The Fields Division :—

There would be no disadvantage whatever in having the mixture made up at the works, as the constituents mentioned can be safely mixed, and if the material is kept dry no deterioration will take place over a period of four or five weeks.

EARLY-CALVING HEIFER.

"NEW CHUM," Waipukurau :—

A grade Jersey heifer six months old got to a Jersey bull, with the result that she is due to calve when only about fifteen months. I would be glad of advice as to when she should be sent to the bull again, how long should she be milked before drying off, and whether any special feeding, other than good pasture, would be beneficial to help build her up. Would her calf, if a heifer, be worth saving?

The Live-stock Division :—

It would be as well not to mate the heifer again for at least six months or longer if she is not well grown. The period of milking would depend on the extent of the flow of milk when she calves. She should not be dried off too quickly, in case permanent injury is done to the udder. If the pasture is good and continues plentiful no other feed should be necessary, but a small feed of crushed oats and bran once daily would assist in building up her constitution. The calf should be worth saving.

SIZES OF FARMS IN NEW ZEALAND.

THE average area of occupied holdings of over one acre in 1924 was 505·84 acres, the average for the North Island being considerably smaller than that for the South. The following table gives particulars by land districts :—

Land District.	Number of Holdings occupied.	Aggregate Area.	Average Area per Holding.	
			1924.	1923.
		Acres.	Acres.	Acres.
North Island—				
North Auckland ..	13,898	3,022,819	217·50	220·85
Auckland	12,287	4,126,880	335·87	339·35
Gisborne	2,859	2,755,115	963·66	966·91
Hawke's Bay	4,396	2,034,663	462·84	493·32
Taranaki	6,661	1,724,336	258·87	261·29
Wellington	11,271	4,964,444	440·46	441·86
South Island—				
Nelson	3,870	1,301,687	336·35	338·94
Marlborough	2,010	2,484,876	1,236·26	1,234·34
Westland	1,497	1,780,719	1,189·53	1,200·15
Canterbury	13,516	8,150,113	603·00	605·41
Otago	8,006	7,994,927	998·62	997·54
Southland	5,868	3,231,985	550·78	550·72
Totals for Dominion	86,139	43,572,564	505·84	510·45

Since 1918 there has been a steady decrease in the average area occupied in holdings of one acre or more. This decrease was not stayed in 1924, the average for which is 4·61 acres less than for 1923. This decrease continues in spite of the fact that from time to time small holdings contained within boroughs (the boundaries of which are altered) are withdrawn from the scope of this inquiry.

—*Census and Statistics Office Report.*

PUBLICATIONS RECEIVED.

"NEW ZEALAND FLOCK-BOOK (SOUTH ISLAND)," vol. xx, 1924. Published by the Council of the New Zealand Sheep-breeders' Association (South Island), Christchurch. Comprises the following breeds: Lincoln, English Leicester, Border Leicester, Romney, Southdown, Shropshire, Merino, Corriedale, Ryeland, Suffolk, Dorset Horn, and Halfbred.

"FORDSON FARMING IN NEW ZEALAND." Compiled by the Charles [illegible] Agency, Wellington. Gives the experience of many New Zealand farmers with this machine and tractor-power generally.

Grading of Dairy-produce at Napier.—Napier has been appointed a grading-port under the Dairy Industry Act, with the buildings in the occupation of Messrs. Niven and Co., at Port Ahuriri, as a store for the storage, cooling, or freezing of dairy-produce prior to export. This came into force on 11th December.

Precautions against Foot-and-mouth Disease.—The State of Texas has been added to those States of the American Union from which the importation of certain goods into New Zealand is prohibited. The full order concerning this matter was published in the *Journal* for August last (page 140).

The New Zealand

Journal of Agriculture.

VOL. XXX.—No. 2.

WELLINGTON, 20TH FEBRUARY, 1925.

IRRIGATION AND ITS PRACTICE.

(Concluded.)

VII. THE ESTABLISHMENT AND MANAGEMENT OF IRRIGATED GRASS PASTURES.

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin, and J. R. MARKS, A.M.Inst.C.E., M.N.Z.Soc.C.E., District Engineer, Public Works Department, Dunedin.

AS has been stated, lucerne is one of the most important forage crops in Central Otago, and for the production of a high-class cured hay it cannot be excelled. On account, however, of its tendency to bloat stock it must be regarded as unsatisfactory in general as a pasture crop. Very little cured hay is used for feeding cattle or sheep during the summer months, as the farmer looks for grass pastures to supply the bulk of the summer feed. The average irrigator usually keeps, in addition to his dairy cows and horses, a small flock of sheep, and where such is the case good irrigated pastures undoubtedly are a most valuable asset. Central Otago is ideally adapted to the growing of pasture grasses and clovers. There, with an abundance of water coupled with soil low in lime requirement, and the presence of almost continuous sunshine, conditions are ideal for the establishment of first-class pastures.

For fattening purposes or the production of milk a well-designed pasture containing a proper proportion of clover and grasses in its composition is unsurpassable. Such pastures fit excellently into any

system of crop-rotation, and are very effective in building up and maintaining the fertility of the soil. As has already been mentioned, some of the soils in Central Otago are low in organic matter or humus, and in such cases by growing grass for several years and depasturing stock thereon the ground will be considerably benefited, thus paving the way for further crops demanding a higher state of fertility. Sufficient has been stated to show that the pasture is to be recognized as the most valuable asset that can be grown by the irrigator, and every effort should be expended in having more than half his farm laid down in this crop.

As a crop, pasture is probably the least understood and most maltreated. Insufficient attention is given to the adaptability or otherwise of certain grasses and clover to soil and climatic conditions. The writers have examined many irrigated pastures, and have interrogated the owners in regard to their method of establishment, mixtures used, and subsequent treatment; and sufficient indication has been obtained showing clearly the need for a brief account being given of the lines along which pastures should be laid down in Central Otago.

LAND SUITABLE FOR PASTURE.

The best pastures will be obtained from the richest ground. It is quite wrong to assume that only the poorer pieces of land unsuitable for general cropping should be utilized for growing pastures. In many cases, however, on account of the steepness of land or its undulating nature, it may be regarded as the most economical proposition to use such types of ground for growing grass. Every farm has its piece of land which might be regarded as waste on account either of its low-lying, underdrained condition or stony nature. Such pieces of land if sown with suitable grasses can readily be brought to a comparatively high state of production. Many cases have been noted where farmers have devoted the bulk of their best land to the production of hay and commercial crops, and have relegated to their pastures the small remaining portion of poorer ground. In such cases it invariably follows that there is a lack of summer feed and a surplus of winter hay, this pointing to bad regulation of their cropping system. Indications have already been given of the opinion of the writers that as little hay should be grown as possible, sufficient only being conserved for the winter feeding of the farm stock. In view of the fact that the life of permanent-grass pastures will be extended over many years, it is advisable to have them conveniently located. Again, the fact that they require frequent irrigations should be borne in mind, and on this account they should be located where irrigation can be readily and easily carried out.

SUITABLE MIXTURES.

In laying down grass pastures the aim should be to obtain a judicious mixture of grass and clovers in such a proportion as to produce a palatable sole of grass with a high feeding-value. It is to be recognized that there is no single variety of grass having all the characteristics that are looked for in an irrigated pasture. A mixture of several varieties of grasses and clovers is usually desirable, and gives better results than any single variety sown alone. The different grasses

have varying times of maximum growth, and since with the aid of irrigation the pasture can be maintained in good growing-condition through the entire irrigation season it is quite necessary that a mixture should be sown containing some early-, medium-, and late-growing varieties.

In Central Otago perennial rye-grass, Poa pratensis, alsike clover, and white clover grow exceptionally well, and every permanent pasture should certainly contain a proportion of these plants. For ordinary conditions such as exist generally in Central Otago the following mixture is likely to prove highly satisfactory: Perennial rye-grass, 14 lb.; cocksfoot, 6 lb.; timothy, 4 lb; Poa pratensis, 2 lb.; alsike clover, 2 lb.; white clover, 1 lb.: total, 29 lb. per acre.

FIG. 59. AYRSHIRE AND RED POLL DAIRY CATTLE ON IRRIGATED GRASS PASTURE AT GALLOWAY IRRIGATION FARM, CENTRAL OTAGO.

Where a more simple mixture is required for sowing on rough sidelings the following can be used with satisfactory results: Perennial rye-grass, 16 lb.; cocksfoot, 6 lb.; alsike, 2 lb.: total, 24 lb. per acre.

Where it is intended only to sow down a temporary pasture under irrigation, with the idea of breaking it up at the expiry of the season following sowing, the following mixture is quite suitable: Italian rye-grass, 18 lb.; alsike, 4 lb.: total, 22 lb. per acre.

It is to be remembered that in these suggested mixtures the weights of seed given are not intended to be adhered to in every circumstance, but should act as a guide in regard to the proportions of different grasses and clovers to be used. Preference is given to the use of alsike rather than red clover in the mixtures on account of there being less likelihood of its causing bloat than the latter, and the fact that when autumn-sown it grows much better than red clover. Under Central

Otago conditions white clover appears to grow without seeding in many localities whenever water is applied to the soil. Where such is the case there is little need to use white-clover seed in the mixture.

SOWING.

As with lucerne, a good seed-bed will give the most satisfactory results, and neglect of this has often resulted in many unsatisfactory soles of grass being obtained. The aim should be to obtain a seed-bed with the soil fine, firm, and moist, as against one that is open and lumpy with a tendency to dry out, thus causing the death of the seedlings. Generally speaking, the ground should be ploughed in the autumn and allowed to lie exposed to the winter frosts. In the spring it should be double disked and harrowed, after which the leveller should be used to eliminate small surface inequalities. Sowing may be carried out from the beginning of November to the middle of February. If sown too early or too late, damage by lifting of the soil as a result of frosts is likely to occur. Broadcasting the seed with a hand-seeder of a good type is quite satisfactory. Where a grass-seed attachment is used in conjunction with the ordinary grain-drill, care must be taken to sow the seed as shallow as possible. If it can be sown on the surface and then harrowed in by either a brush or wire-netting harrow (described elsewhere), so much the better. The use of a nurse-crop in sowing down grass, although often adopted for economical purposes, is not recommended.

Care must be taken to see that the ground is sufficiently moist at the time of sowing to ensure a good germination. In actual practice it will usually be necessary to irrigate the ground prior to sowing, following the irrigation by a good harrowing. The importance of using good seed of high germination and freedom from weed-seeds cannot be overstressed.

Where grass is being laid down on a steep sideling it is rarely advisable to plough the ground, on account of the liability of serious erosion taking place when water is applied. The practice to be adopted in such a case would be to give the ground a good double disking and follow this by harrowing. Sowing can then be carried out in the usual manner, and although such conditions cannot be regarded as ideal a good strike will usually be obtained.

IRRIGATION OF GRASS.

A grass pasture, on account of the great growth made throughout the season, requires frequent irrigations to maintain a fresh luxuriant flush of grass. The principles outlined for the irrigation of lucerne apply equally to the irrigation of grass. The system of irrigation adopted will to a great extent be regulated by the grade of land upon which the grass is being grown. For moderately flat lands either the border method or the close-furrow method can be adopted. On steeper land contour irrigation will be practised. From the time of sowing until the grass is well established is the most critical time in the management of a grass pasture. The length of time between irrigations will depend upon the type of soil and weather conditions. The applications of water need not be heavy, but should be given at frequent intervals to keep the surface of the ground moist. It is to be remembered that, as the roots of grasses are comparatively shallow, light

frequent irrigations will give better and more economic results than heavy irrigations extended over long intervals. If a pasture is to produce maximum returns it is necessary to keep it growing continuously throughout the season. It is sometimes stated that growing grass under irrigation is an unprofitable undertaking on account of the large supply of moisture required by the pastures. The water requirement of grass is no higher than that of lucerne; but it is waste of water to apply by means of irrigation as much to grass as would be done in the case of lucerne.

Where grass is sown in spring there will probably be a fair amount of feed at the end of the first summer. Under such circumstances light grazing should be carried out, thus allowing sorrel and other weeds to be eaten off and encouraging the grasses to stool out before coming into seed. The young pasture must not be eaten too closely or over-consolidated by the trampling of stock.

SUBDIVISION OF FIELDS, AND PROVISION OF SHELTER.

It is generally advisable to divide a large field into sections, the number of divisions being dependent on the size of the field, the method of irrigation employed, and the number of stock being grazed. The value of changing stock from one section to another, and thus allowing each section spells in rotation, cannot be overemphasized. This practice is extremely important when dealing with irrigated grass. Nothing will more quickly ruin an irrigated pasture than continuous grazing, and the only way in which this can be avoided is to subdivide the grazing-field. In the case, say, of a 30-acre field it is desirable to subdivide it into three 10-acre fields. This will allow for the animals being changed from one field to another while irrigation is being carried out. It should never be necessary to irrigate a pasture while the animals are grazing upon it, since they would considerably damage it by cutting up the turf with their feet. For these and other reasons the practice of alternating from one pasture to another ensures fresher, better, and far more abundant feed.

Provision of shelter-trees for the stock depasturing on the grass is highly important. As the animals spend the bulk of their time in the fields, provision should be made, by the planting of adequate belts or clumps of trees, to shelter them from the hot sun or cold biting winds.

FIG. 60. LUCERNE STACKS AT GALLOWAY IRRIGATION FARM.

CONCLUSION.

In presenting this series of articles, which have been designed primarily for the farmers of Central Otago, it is realized by the writers that only a few of the most salient features in regard to the wide subject of "Irrigation and its Practice" have been touched upon. Although irrigation is of great antiquity, there is much to learn, and still more to unlearn, before perfection in its practice can be attained. Experience, the master teacher, will at all times prove the most valuable factor in regard to the irrigation farmer realizing his aims and ambitions; and, being practically without precedent in New Zealand to guide him, he must rely to a large extent on his own sound judgment. The conviction remains, however, that, with the intelligent and industrious class of farmer who is taking up this type of farming, Central Otago has a great future before it.

Finally, our thanks are due to Mr. F. W. Furkert, Engineer-in-Chief of the Public Works Department, and to Mr. A. H. Cockayne, Director of the Fields Division, Department of Agriculture, for the helpful suggestions and advice rendered in the compilation of this series of articles.

CONTROL WORK ON MEALY BUG AND PEAR-MIDGE.

REARING and distribution of the *Cryptolaemus* ladybird for the control of apple mealy bug have been brought up to a considerable scale this season at the Department's Biological Laboratory. From a colony carried through the winter from last autumn sufficient quantities of beetles have been reared for liberation at intervals at Auckland, Hastings, Blenheim, and Motueka, and further material is being sent out. Reports from Motueka state that the beetle there is already showing its efficiency. Messrs. G. Stratford and W. H. Rice, of the Horticulture Division, have carried out the work of liberation at Motueka and Hastings respectively.

The latest results in the use of calcium cyanide as a soil-fumigant against the pear-midge are extremely promising. Before an account of the work is issued the outcome of certain experiments is being awaited.

—*David Miller, Entomologist.*

HECTOR MEMORIAL AWARD, 1924.

THE Hector Memorial Medal and Prize for the year 1924 have been awarded to Mr. B. C. Aston, Chemist to the Department of Agriculture, for his researches on the chemistry of "bush sickness" in domestic ruminant stock, and of New Zealand flora. It will be recalled that a series of articles by Mr. Aston giving an account of the work in field and laboratory, and developing his "iron-starvation" theory, were published in the *Journal* during last year. The prize and medal of the Hector Memorial Research Fund are awarded annually to the investigator who in the opinion of the Board of Governors of the New Zealand Institute has done most towards the advancement of that branch of science to which the prize and medal are in each year allotted. The allotment is made in rotation for the following subjects: Botany, chemistry, ethnology, geology, physics (including mathematics and astronomy), and zoology (including animal physiology).

VARIATIONS IN THE PERCENTAGE OF BUTTERFAT IN MILK.

A STUDY BASED ON NEW ZEALAND C.O.R. DATA.

(Continued.)

W. N. PATON, Dairy Division, Wellington.

III. MONTHLY VARIATIONS.

MONTHLY variations in test are fluctuations which occur as the lactation period advances. They are not to be confused with variations which occur from day to day. Lactational or monthly variations are influenced by practically a different set of factors from those which affect daily variations. As it is the phase of test variations which concerns C.O.R. breeders most, it is hoped that this article will help to clear certain points for them. The subject has been treated as simply as possible, and as many of the results as space would permit have been represented by graphs.

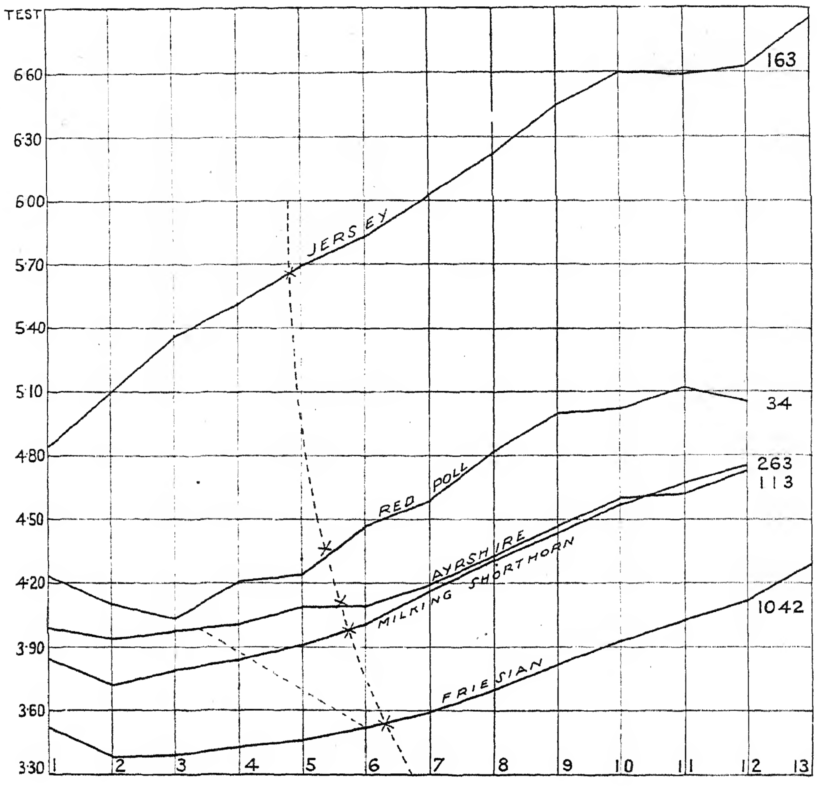
LACTATIONAL VARIATIONS DUE TO BREED.

The difference in lactational variations due to breed are readily apparent in Graph 4 and in Table 7 from which the curves were plotted. The figures in the table represent the averages for all first-class records for the chief breeds up to 31st December, 1923, except in the case of the Jerseys ; with the latter figures for one year only are given.*

The first most noticeable point is that the Jersey graph line is different in general conformation, inasmuch as it exhibits an upward trend from beginning to end, whereas for the other breeds a " dip " appears in the first half of each curve. In the case of the Friesians, Milking Shorthorns, and Ayrshires the length of this " dip " seems to bear some relation to the average test of the breed, as it will be noticed that it becomes less as we consider these breeds in the ascending order of their average tests. To illustrate this more clearly, points have been taken on these curves where they again reach the same point as indicated by the commencement of the curves, and these joined by the straight dotted line shown.† The fact that this line is a straight line may be merely accidental. Apart from the surprising and interesting nature of the result, it is possible that there is some significance attachable to it. Why does it apply only to these three breeds ? The following extract from page 1008 of the *British Friesian Journal* of October, 1924, may help to answer the question : " Among the well-known breeds which are known to have their origin in the cattle of the Netherlands are the Hollandaise of Belgium, Flamande, Boulonaise, and Artesienne of France, Brittenburg and Oldenburg of

* Much laborious work is entailed in obtaining results for lactational-test variations, and it is regretted that time would not permit all the Jerseys being included. The year selected was 1918–19, as this was considered to be a typical average year, and should therefore give a good idea of what the complete figures would reveal.

† The equation for this line is : Number of days in the dip of the lactational-test curve of a particular breed = (722 — 163) times the average test of that breed.



GRAPH 4. LACTATIONAL-TEST CURVES OF THE CHIEF BREEDS.

Germany, and the Kolmogorian breed of Russia. Eminent breed historians, such as Professor Low and Howard, tell us that these same Dutch cattle in the seventeenth and eighteenth centuries helped to form the foundation of the Teeswater breed, now known as the Shorthorn, and of the Dunlop, from which the Ayrshire has been developed by Scottish dairymen." It would be interesting to ascertain if the result obtained held good for the other breeds which are claimed to have their origin in the Dutch cattle. Of course, all curves would need to be obtained from records secured under similar conditions, otherwise the comparison would not be a true one.

The other dotted line shown in the graph joins the points where the average tests would lie on the respective "smoothed" curves. The parabola obtained is interesting, as it is considered probable that curves for other breeds tested in New Zealand would cut this line at points corresponding to the average tests for such breeds.

In Table 8 each monthly test as given in Table 7 is divided by the average test and then multiplied by 100—*i.e.*, the lactational tests are expressed as percentages of the annual test.* By this method

* By "annual test" is meant the average test for the lactation, this being equivalent to the test of the whole of the milk produced taken in one lot.

Table 7. Lactational Tests of the Chief Breeds.

Breed.	Number of Records.	Lactational Tests given in Order.													Average Test.
		1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	
Jersey	163	4·85	5·11	5·37	5·52	5·70	5·83	6·03	6·22	6·45	6·60	6·59	6·63	6·86	5·66
Red Poll	34	4·24	4·11	4·04	4·22	4·25	4·48	4·59	4·82	5·00	5·02	5·12	5·06	..	4·37
Ayrshire..	113	4·00	3·95	3·99	4·02	4·10	4·10	4·20	4·33	4·47	4·60	4·62	4·73	..	4·12
Milking Shorthorn ..	263	3·85	3·73	3·80	3·85	3·92	4·02	4·17	4·32	4·44	4·57	4·67	4·75	..	3·99
Friesian	1,042	3·53	3·39	3·40	3·44	3·47	3·53	3·60	3·71	3·82	3·93	4·03	4·12	4·29	3·55

NOTE.—The average tests for the various breeds here quoted were obtained in the following manner: The total butterfat is divided by the total milk-production for each cow, and the arithmetical average of all these average tests is the result quoted. In the first article of this series the average tests for the different breeds were obtained by dividing the total butterfat for all cows by the total milk for all cows. It will be noticed there is very little difference between the two sets of results. Jersey figures in this case are for 163 records as against 2,391 previously (see Table 13).

Table 8. Lactational Tests of the Chief Breeds expressed as Percentages of the respective Average Annual Test.

Breed.	Number of Records.	Lactational Tests given in Order.												
		1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.
Jersey	163	86	90	95	98	101	103	107	110	114	117	116	117	121
Red Poll	34	97	94	92	97	97	103	105	110	114	115	117	116	..
Ayrshire	113	97	96	97	98	100	100	102	105	109	112	112	115	..
Milking Shorthorn ..	263	97	94	95	97	98	101	105	109	112	115	117	119	..
Friesian	1,042	99	96	96	97	98	99	101	105	108	111	113	116	121

all figures are reduced to one basis, and comparison can thus be more readily made. One striking point is that for the fourth test all breeds practically coincide. The Red Polls and Jerseys agree fairly closely from the sixth test onwards, and the Ayrshires and Friesians agree quite well right through except for the difference in dip. It is interesting to note that for the first lactational test the Jerseys commence at a considerably lower point than do the other breeds.

The next aspect worthy of consideration is the average total range of variation—*i.e.*, the difference in the average of the highest and lowest tests for all cows of each breed. Table 9 gives the results of this analysis. The only point of particular interest brought out in this table is in regard to the average lowest test. With the exception of the Jerseys, it appears that the average lowest lactational test is practically a constant percentage of the average annual test. The average highest lactational test, therefore, is mainly responsible for the total range of variation. The total range of variation, however, appears to be a peculiarity of the breed, as it bears no apparent relation to the average test for the year.

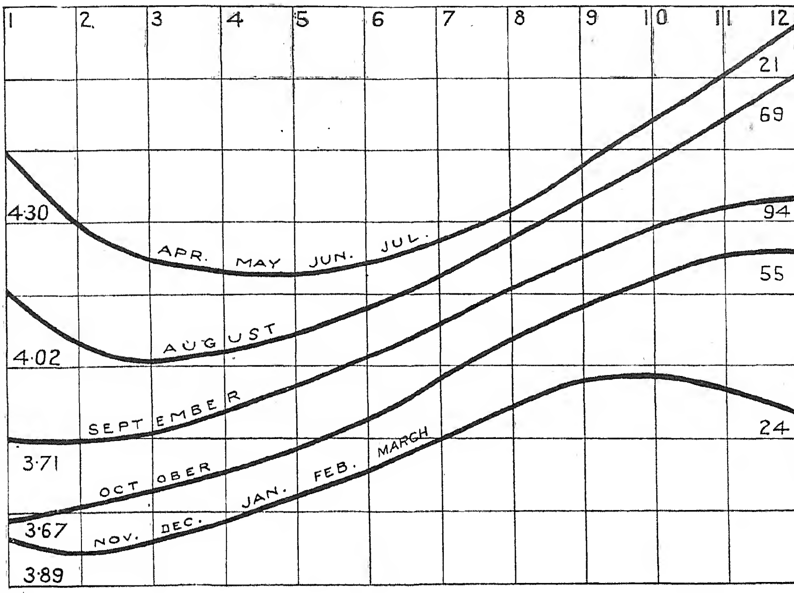
Table 9. Range of Variation in Lactational Tests of the Chief Breeds.

Breed.	Number of Records.	Average Test.	Lactational Tests.		Total Range of Variation.	Percentage Range of Variation.	Highest Test expressed as Percentage of Average Test.	Lowest Test expressed as Percentage of Average Test.
			Average Highest Test.	Average Lowest Test.				
Jersey ..	163	5·66	7·01	4·68	2·33	41	124	83
Red Poll..	34	4·37	5·51	3·82	1·69	39	126	87
Milking Shorthorn	263	3·99	5·01	3·47	1·54	39	126	87
Friesian ..	1,042	3·55	4·37	3·12	1·25	35	123	88
Ayrshire..	113	4·12	4·95	3·64	1·31	32	120	88

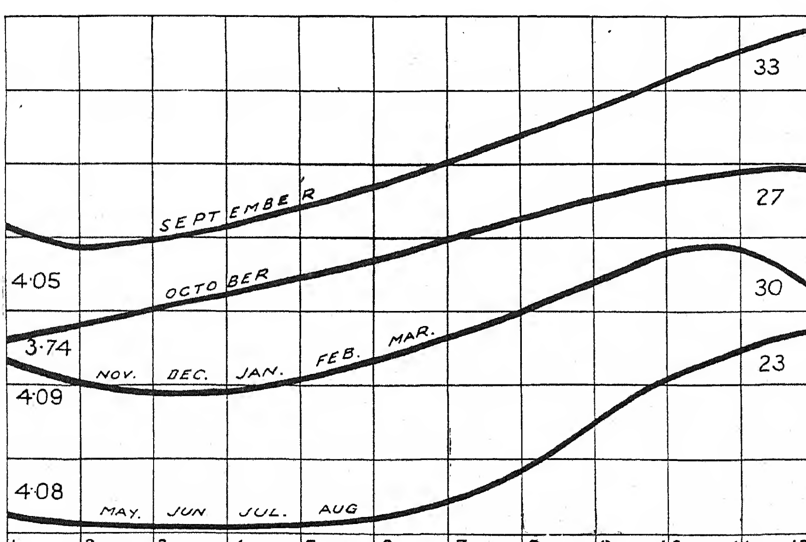
LACTATIONAL VARIATIONS DUE TO TIME OF YEAR OF CALVING.

In Graphs 5 and 6 it is readily apparent that the influence of the factor of time of year of calving on the lactational-test variations is considerable.* The first test and the number of records for each curve are given on the left and right respectively. In conformation the curves for similar periods for Ayrshires and Milking Shorthorns bear a striking resemblance, and this indicates that the effect on these two breeds is similar. The dip in the curves becomes smaller up to the month of October, when it almost entirely disappears. The result is practically a straight line with a uniform upward trend from beginning to end. The curves for the summer period exhibit a shallow dip and a "falling away" towards the latter end. This falling-away tendency can be noticed slightly in the September and more distinctly in the October curves. However, the quantity of data available in the case of the Friesians is sufficiently large to show curves for each month of commencement.

* The curves shown in these two graphs are of the "smoothed" type.



GRAPH 5. LACTATIONAL-TEST CURVES FOR MILKING-SHORTHORN COWS COMMENCING AT DIFFERENT PERIODS OF THE YEAR.



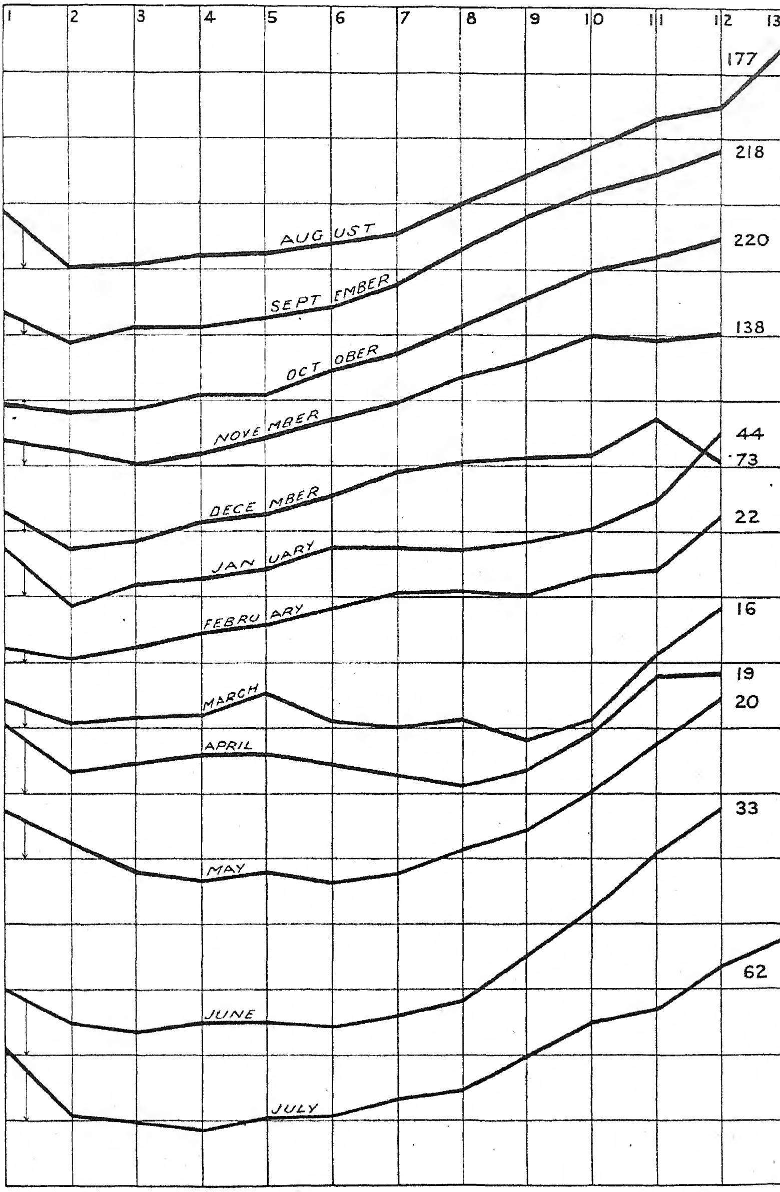
GRAPH 6. LACTATIONAL-TEST CURVES FOR AYRSHIRE COWS COMMENCING AT DIFFERENT PERIODS OF THE YEAR.

The vertical side of each square in both graphs equals 0·30 per cent.

The results are presented in Graph 7, in which the numbers on the right give the number of records included for each curve. From August to December that portion of the curves from the tenth to the twelfth tests has been gradually depressed, until for December the twelfth point is below that for the tenth. From August to October the dip becomes less, until for October it is very slight. However, the dip occurs again to a greater extent in the November curve, with the depth of the dip increasing up to January. In the December curve a flattening-out of the portion from the ninth to eleventh tests will be noticed as compared with the same portion in the November curve. In January we have a "two-dip" curve, the second dip making its appearance at the eighth test. The February curve has the second dip at the ninth test, while for March we have two pronounced dips separated by a high point at the fifth test. From April to July the two dips are gradually transformed into one long dip by the gradual depression of the high point at the fifth test. May, June, and July curves climb very steeply from the eighth test onwards, June having the greatest gradient.

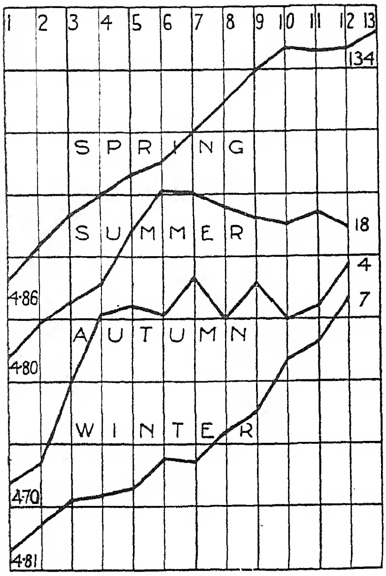
Average lactational tests have been run out for the four chief breeds, grouping separately spring, summer, autumn, and winter calvers, as shown in Graph 8. Considering the graphs for Friesians, Milking Shorthorns, and Ayrshires only, a marked similarity is noticeable in the respective curves for cows commencing in different seasons of the year. The spring curves have first a small dip, and then a gradual upward trend right to the end. The summer curves are shaped something like the letter "S" lying on its side and considerably straightened out, the final regression of the test being well borne out. The autumn curves are "two-dip" curves, the dips being separated at the fifth test. In the case of the Ayrshires there are really three dips, but this is considered unimportant owing to the very small number of records for this curve. It is satisfactory, however, to observe that the characteristic of the fifth point is nevertheless quite apparent. All the winter curves have long and deep dips, with fairly sharp "risings" at the ends. The Jersey graph presents what appears quite a different position from those of the other breeds. As there is no dip in the first portion of each of the curves, comparison at first seems difficult. However, if we compare the respective curves from the seventh test onwards it is obvious that the agreement for the four breeds is quite close. As in the case of the Milking Shorthorns and Ayrshires, autumn calvers are poorly represented numerically in the Jerseys, and the curve for this reason is rather irregular. Nevertheless the fifth test ranks high. To properly follow the effect of the time of commencement on the lactational-test curves for the Jerseys, all the Jersey data would need to be utilized, as has been done in the case of the Friesians, in order that curves could be shown for each month of commencement.

The difference in range of variation of the lactational tests for cows commencing at different periods of the year is of some interest. In Table 10 figures for the chief breeds are given according to the season of the year of commencement. In considering range of variation the year seems to be divided into two rather than into four, since on the one hand figures for spring and winter, and on the other figures for summer and autumn, agree fairly closely. Range-of-variation figures were run

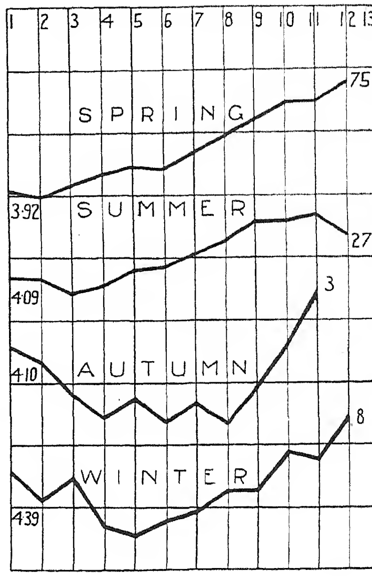


GRAPH 7. LACTATIONAL-TEST CURVES FOR FRIESIAN COWS COMMENCING IN DIFFERENT MONTHS OF THE YEAR. (VERTICAL SIDE OF EACH SQUARE EQUALS 0·30 PER CENT.)

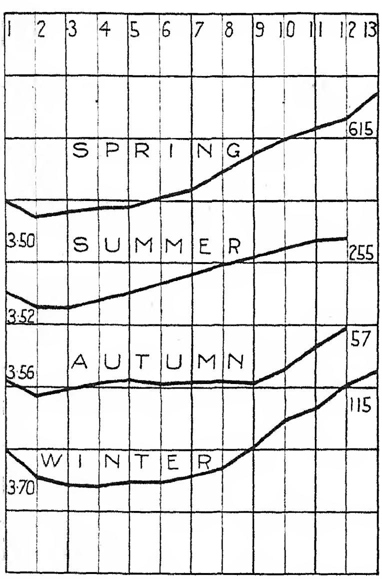
The arrow connected to each curve indicates the 3·4-per-cent. line for that particular curve. By this means tests may be read off for all curves.



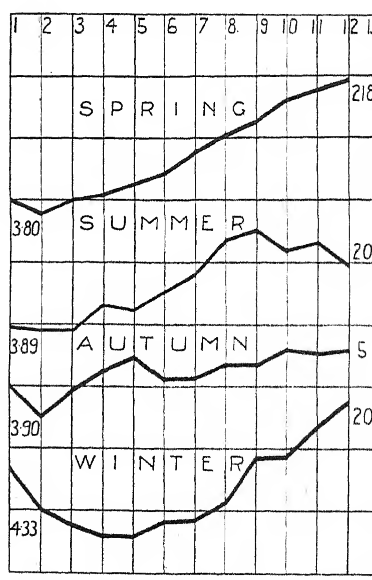
Jerseys.



Ayrshires.



Friesians.



Milking Shorthorns.

GRAPH 8. LACTATIONAL-TEST CURVES FOR SPRING, SUMMER, AUTUMN, AND WINTER CALVERS OF THE CHIEF BREEDS.

The vertical side of each square equals 0·50 per cent. Figures on left are the first test for each curve; figures on right give the number of records for each curve.

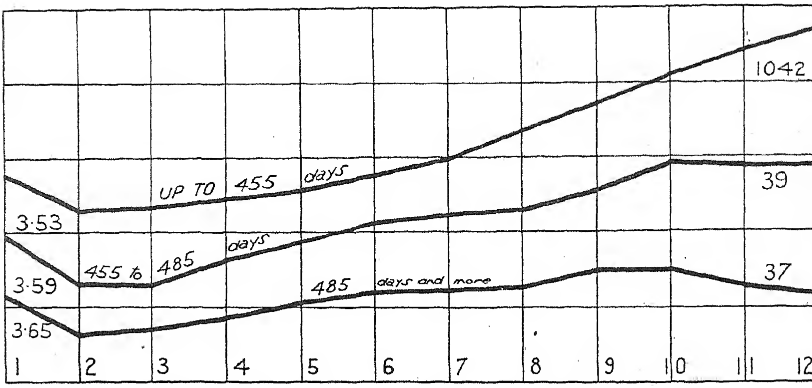
out for several breeds for different months of commencement, and it was found that the greatest ranges occurred for July, August, September, and October. The next highest were May, June, and November, while December, January, February, March, and April ranked lowest. We arrive at the interesting conclusion that cows commencing during the wet season of the year show a greater range of variation in test than do cows calving in the dry season, although in each case cows were milked through all periods of the year.

Table 10. Range of Variation in Lactational Tests of Chief Breeds for Cows commencing during Different Periods of the Year.

Period.	Number of Records.	Average Test.	Lactational Tests.		Total Range of Variation.	Percentage Range of Variation.	Highest Test expressed as Percentage of Average Test.	Lowest Test expressed as Percentage of Average Test.
			Average Highest Test.	Average Lowest Test.				
			JERSEYS.					
Spring ..	134	5·69	7·09	4·70	2·39	42	125	83
Summer ..	18	5·50	6·52	4·57	1·95	36	119	83
Autumn ..	4	5·79	6·75	4·63	2·12	37	117	80
Winter ..	7	5·56	6·81	4·67	2·14	38	122	84
			MILKING SHORTHORNS.					
Spring ..	218	3·98	5·02	3·45	1·57	39	126	87
Summer ..	20	4·09	4·97	3·56	1·41	34	121	87
Autumn ..	5	3·96	4·65	3·58	1·07	27	117	90
Winter ..	20	4·07	5·00	3·51	1·49	37	123	86
			FRIESIANS.					
Spring ..	615	3·54	4·41	3·11	1·30	37	125	88
Summer ..	255	3·56	4·26	3·15	1·11	31	120	89
Autumn ..	57	3·55	4·21	3·14	1·07	30	119	89
Winter ..	115	3·56	4·46	3·13	1·33	37	125	88
			AYRSHIRES.					
Spring ..	75	4·12	4·97	3·62	1·35	33	121	88
Summer ..	27	4·14	4·86	3·72	1·14	28	117	89
Autumn ..	3	3·74	4·50	3·43	1·07	29	120	91
Winter ..	8	4·18	5·16	3·66	1·50	36	123	87

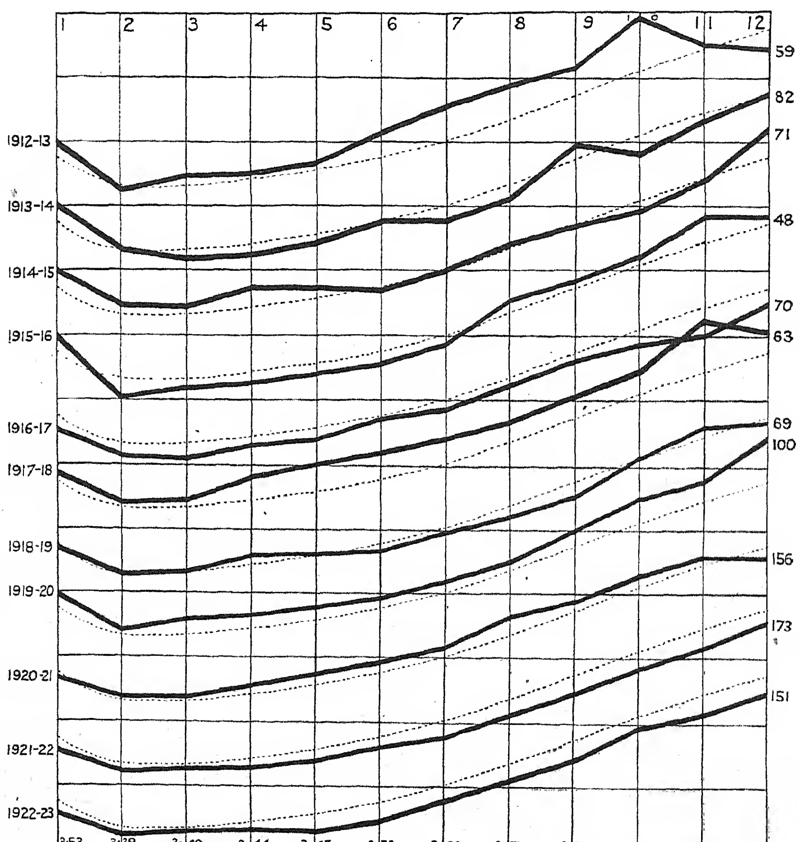
LACTATIONAL VARIATIONS DUE TO LENGTH OF PERIOD OF GESTATION.

The length of time a cow is in calf during test has considerable influence on the lactational-test variations, inasmuch as the general conformation of the monthly-test curve is appreciably affected. This is clearly shown in Graph 9. In compiling this graph records for the Friesians were taken. On the left of the graph the first test for each curve is indicated, and along the curves the limits of the number of days between calving at commencement of test and subsequent calving are given. The numbers on the right indicate the number of records represented in the respective curves. Only three curves are shown, but these serve to indicate the trend of the variation very well. More curves were not shown for the reason that some would necessarily have been somewhat irregular owing to the smallness of the number of records included. The top curve is for all first-class certificates, being



GRAPH 9. FRIESIAN LACTATIONAL-TEST CURVES, SHOWING EFFECT OF PERIOD OF GESTATION.

Vertical side of each square equals 0·30 per cent.



GRAPH 10. FRIESIAN LACTATIONAL-TEST CURVES FOR DIFFERENT SEASONS.

Vertical side of each square equals 0·30 per cent.

for cows calving within 455 days after start of test. The middle one represents all second-class certificates, and also includes other records equivalent to second class but which were made before the introduction of the second-class certificate, and are for cows calving between 455 and 485 days after start of test. The bottom curve represents some of the records for which calvings were available and for which the period was 485 days and more—*i.e.*, all these cows failed on subsequent calving for both first and second-class certificates. From the ninth test onwards the difference of trend in these curves is readily apparent. No difference in general conformation was found in the curves for the limits—515–545, and 545 and more days. The change in trend of the test curves evidently ceased after a period of about 515 days. From this it may be accepted that the effect of gestation on the test curve of a cow calving 515 days after commencement is negligible. In other words, a cow may be pregnant for a period up to about four and a half months during a 365-day lactation without this influencing the test in any way. A. C. Ragsdale, C. W. Turner, and S. Brody stated as a conclusion to their investigation on the "Effect of Gestation upon Lactation in the Dairy Cow" that when during lactation the period of pregnancy exceeds about five months the effect of pregnancy becomes apparent in a reduced rate of milk-secretion (*Journal of Dairy Science*). When it is remembered that quality and quantity of milk depend on one another to some extent, the fact that the two conclusions quoted agree so closely is not at all surprising.

LACTATIONAL VARIATIONS DUE TO NATURE OF SEASON.

The Friesian data have been utilized to test this factor, and the results are given in Graph 10. The dotted curve in each case denotes the average lactational-test curve for all Friesians, while the whole lines represent the average monthly tests for different seasons. On the left the seasons are given, and on the right the number of records for each season is supplied. By showing the curve for all Friesians each time comparison is considerably facilitated. For reference and comparison, tests for the dotted curve are given at the foot of the graph. In all cases it will be noticeable that the curves do not vary much from the average, and that their general conformation remains fairly uniform. In the case of the 1918–19 season the yearly curve approaches the average right throughout better than for any other season. The Milking Shorthorns gave a similar result.* In general it is found that where bad seasons were experienced the yearly curves lie above, while for good years they lie below, the curve for all years. Good seasons were experienced for 1913–14, 1915–16, 1921–22, and 1922–23, while for 1912–13, 1914–15, 1919–20, and 1920–21 the seasons were considered to be poor ones, and in each case the foregoing statement holds good.

LACTATIONAL VARIATIONS DUE TO CONDITION OF THE COW.

This factor has been already mentioned in the second article of this series, but, as there stated, it has no influence on daily variations in test, since the latter are variations considered for much shorter periods

* It was for this reason that the 1918–19 data of the Jerseys were taken in every instance as being likely to supply the probable average for all Jerseys.

Table 11. Lactational Tests of the Highest-testing Individuals of the Chief Breeds.

Breed.	Monthly Tests given in Order.													Average Test.	First Test made in
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.		
Jersey	5·70	7·30	6·50	7·40	8·90	9·60	8·10	8·30	8·50	8·30	8·55	8·34	..	7·65	November.
Red Poll	4·47	4·90	5·34	5·13	5·27	5·44	5·10	5·61	6·05	5·44	5·88	5·37	..	5·29	October.
Ayrshire	4·50	4·65	5·48	5·58	5·20	5·30	5·64	5·29	5·49	6·21	..	..	..	5·25	September.
Milking Shorthorn ..	5·80	5·80	5·10	4·60	5·50	5·10	5·60	6·10	6·20	6·50	7·10	6·30	..	5·60	August.
Friesian	4·05	4·34	4·80	4·58	4·37	4·91	5·27	5·25	5·32	5·70	5·91	5·64	..	4·89	July.

Table 12. Lactational Tests of the Lowest-testing Individuals of the Chief Breeds.

Breed.	Monthly Tests given in Order.													Average Test.	First Test made in
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.		
Jersey	2·60	3·78	3·14	3·95	3·85	4·09	4·78	4·10	4·24	4·44	4·81	4·64	..	3·85	November.
Red Poll	3·50	3·80	3·43	3·33	3·79	3·90	3·99	3·88	3·74	3·91	3·99	3·86	..	3·72	October.
Ayrshire	3·60	3·50	3·50	3·10	3·40	3·00	3·10	3·00	3·20	3·20	..	..	..	3·29	December.
Milking Shorthorn ..	3·90	3·34	3·04	2·80	2·90	3·04	3·17	2·95	3·34	3·41	3·29	3·48	..	3·16	August.
Friesian	2·29	3·08	2·39	2·61	2·54	2·80	3·45	3·10	2·94	2·83	..	..	..	2·74	August.

than a month. The condition of a cow at time of calving is believed to somewhat influence the monthly test curve. Unfortunately, our C.O.R. data cannot be used in this case, since no record is obtained in regard to the condition of a cow at commencement of test.

There are two kinds of condition, known respectively as "soft" and "hard," and either is obtained by difference in ration. As the names indicate, a soft condition is soon reduced, and is suitable for butterfat trials at shows, while a hard condition is not reduced so quickly by flush of milk-production, and "milks off" much slower. The latter is therefore the better condition to obtain in fitting a cow for C.O.R. test. The test curves for poor-, soft-, and hard-conditioned cows should show a difference in conformation one from the other, and all would no doubt be influenced by feeding during test. It is patent, therefore, that the whole question could be properly treated only from the results of a carefully planned experiment.

LACTATIONAL VARIATIONS DUE TO AGE.

A trial with the 1918–19 season Jersey data showed that the lactational-test variations were similar for different ages, all the curves being alike in general conformation. This factor may therefore be dismissed as one which does not materially affect the trend of the lactational-test curves.

LACTATIONAL VARIATIONS DUE TO QUANTITY OF MILK-PRODUCTION.

The 1918–19 two-year-old Jersey figures, when grouped according to quantity of milk-production, produced curves which were all uniform in general conformation. Difference in annual milk-production does not produce difference in the respective lactational-test curves. As a matter of fact, all curves for this factor as well as those for that of age were inclined at practically the same angle.

GENERAL EXAMPLES.

Before passing on to conclusions a few individual examples may prove of interest. In the Tables 11 and 12 the monthly tests are supplied for the highest- and lowest-testing cows of the principal breeds.

Table 13 has been compiled to illustrate how high and how low cows may test during a lactation. The tests quoted were taken from first-class C.O.R. records, and were allowed to stand, the cows at the time of test being normal as far as was known.

Table 13. Highest and Lowest Monthly Tests of the Chief Breeds.

Breed.	Highest Test.	Lowest Test.	Average Test of Breed.*
Jersey	11·60	2·60	5·55
Red Poll	6·50	3·24	4·39
Ayrshire	9·53	2·91	4·11
Milking Shorthorn ..	7·80	2·60	3·97
Friesian	8·00	2·13	3·54

* As given in the first article of this series (*Journal*, September, 1924).

Table 14. Exceptional Examples.

Key.	Order of Tests during Lactation.													Average Test.	Breed.
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.		
A	6·00	5·70	5·80	5·80	6·70	6·60	7·00	7·40	8·10	9·20	9·30	9·20	..	6·65	Jersey.
B	5·20	4·90	6·60	7·10	6·80	6·70	7·30	8·20	9·00	9·40	8·80	..	..	6·67	Jersey.
C	3·64	4·14	3·32	3·78	4·58	5·14	6·00	6·27	8·20	9·53	..	..	..	4·48	Ayrshire.
D	3·33	3·06	3·23	3·22	3·15	3·01	3·02	3·17	3·04	3·18	3·10	3·08	..	3·13	Friesian.
E	3·40	4·00	4·00	4·00	4·00	3·60	3·70	4·00	3·90	3·80	3·90	..	..	3·84	Milking Shorthorn.
F	4·14	3·80	3·99	3·95	3·95	3·95	3·95	4·01	4·31	4·65	4·35	4·40	..	4·09	Jersey.
G	3·50	3·50	3·50	3·60	3·60	3·60	3·60	3·60	3·40	3·30	3·90	4·50	..	3·54	Friesian.
H	3·40	3·40	3·40	3·50	3·80	3·60	3·70	3·80	3·80	3·80	4·00	..	..	3·59	Ayrshire.

Key.

A and B give tests for the same cow for two consecutive seasons, and provide a good example of consistent high testing.
C is a remarkable case of extreme range in variation.
D is an exceptional case of small range in variation.
E, F, G, and H are all examples where a number of consecutive monthly tests have all come out the same.

For the final Table 14 examples have been specially selected from C.O.R. data, and serve to show how remarkably some cows test.

CONCLUSIONS.

To sum up, there appear to be only five factors which materially influence monthly-test variations. They are (1) the breed; (2) time of commencement of lactation during year; (3) length of period of gestation during test; (4) nature of season; and (5) condition of cow, feeding, &c.

NOTE.—Unless otherwise stated the C.O.R. data used in the case of each breed include all first-class records from the year 1913 up to 31st December, 1923. The figures quoted for the Jerseys in each case are for the 1918–19 season, with the exception of Tables 11, 12, and 13, which are for all Jerseys up to 31st December, 1923.

(To be continued.)

THE MAKING OF ARTIFICIAL FARMYARD MANURE.

TRIALS AT LINCOLN.

M. J. SCOTT, B.A. (Cantab.), B.Sc., A.I.C., Canterbury Agricultural College, Lincoln.

WHILE the efficacy of farmyard manure has been variously attributed to its manurial constituents, its colour-producing capacity and consequent warming, its water-holding capacity, its mechanical effect, &c., there appears to be no doubt that its most useful feature in the soil is the giving-off of gas by the action of bacteria which feed on it. Just as yeast feeding on the sugars in dough gives off a gas (carbon dioxide) which causes the bread to rise, so bacteria with an abundant supply of organic matter give off the same gas in the soil, thus aerating it. Further, experience has shown that farmyard manure has a very decided value, and in pre-war England 35,000,000 tons of it were used annually. With the advent of motors and the war demand on pasture lands for the production of cereals, and the consequent decline in the production of fat beef, a considerable falling-off in output of this manure resulted—so much so that the Food Ministry, realizing its economic importance, were at pains to find a means of supplementing the supply. Dr. Hutchison, of the Rothamsted Experimental Station, was able to demonstrate that the bacteria which decompose organic matter in the soil were distributed everywhere, and required for growth only moisture and adequate food-supply.

Since 1919 artificial farmyard manure has been made at Rothamsted and used on various crops. In no case did the yields therefrom differ materially from those obtained from the use of bullock-made dung. This being so, sufficient encouragement from the farming community was forthcoming to warrant the formation of a syndicate consisting of the original investigators and others, calling themselves the Agricultural Development Company (A.D.C.O.), for the making of artificial farmyard manure on a large scale. The process of making, or perhaps the chemicals used for treating the straw, have been patented in England,

America, and elsewhere, but not in New Zealand so far as the writer knows.

In 1921 the writer, then at Rothamsted, was greatly impressed with this process of rotting down straw. Knowing the condition of affairs in Canterbury, where straw is commonly burnt, stock not housed, and farmyard manure consequently not made, he could not help thinking that here was a proposition that sooner or later must commend itself to those of our farmers who want to maintain the life of their soil.

Having subsequently returned to New Zealand, obviously the first thing to be done was to find out if straw would rot in three months under local conditions, and with this in view an attempt was made at the College in January, 1924. We tried six stacks in all—two of wheat, two of oats, one of barley, and one of grass straw—containing a total of about 70 tons. A $2\frac{1}{2}$-horse-power Blackstone engine and pump that delivered from 600 to 900 gallons of water per hour was used. The water was pumped through 2 in. pipes to the middle of the top of the stack, and then distributed in a series of jets through $\frac{1}{8}$ in. holes evenly spaced along a pipe lying on the stack. This pipe was movable, and wet the stack to a distance of 4 ft. to 6 ft. on either side of it. It was moved every half hour or so in order to wet the stack as evenly as possible. As a source of nitrogen, ammonium sulphate was used, and, when in sufficient quantity, appeared to be quite satisfactory.

The amount of water to be used seems a fairly variable quantity locally, owing to the enormous evaporation which takes place in north-west weather. We pumped somewhere between 800 and 1,200 gallons per ton of dry straw. This was done at about fortnightly intervals, pumping always until the run-back—collected in a hole by a drain round the stack—was nearly equal to the capacity of the pump.

The greatest difficulty we had to encounter was getting the stack uniformly wet. Particularly was this so on the old stacks (two-year-old), which, built to keep the water out, invariably "felted" somewhere below the surface and were quite waterproof. There was no difficulty with newly built stacks, which wetted uniformly and rotted completely. To overcome the felting we punched holes in the stack with a long pipe. If such holes are put in on a slant they distribute the water quite well, but if vertical the water merely runs down them to the ground and wets a column of straw only about 6 in. to 12 in. in diameter.

When the rotting is satisfactory the stack loses its stack-like form and becomes just a manure-heap, and sinks till it is about one-third of the original height. We considered the straw sufficiently rotten when it was of a rich dark-brown colour and breakable by twisting a large handful. It is not difficult to see how the stack is wetting by an inspection of the top. Ridges appear where there is dry straw underneath. The temperature rises to between 65° and 75° C.—too hot to place one's hand in the material. It would be advantageous if it could be kept lower, as a great deal of soft tissue is destroyed at such temperatures and the fibrous parts of straw remain as a stringy mass.

Of the six stacks, three and a half rotted sufficiently to be carted out—the barley stack, one and a half of the wheat stacks, and half of each of the oat stacks. Everything rotted that had enough water, but the difficulty of wetting the material throughout was not easily overcome. The grass stack was not persevered with. Wheat or oat straw when crushed splits and allows the water to get inside, where it

is absorbed by the pith. Grass-straw does not split in this way, and consequently no amount of wetting would cause it to absorb any quantity of water.

In all we expected between 250 and 280 tons of farmyard manure, and we carted out about 180 tons. As already stated, operations were commenced in January, and the dung was ploughed under in June last, being applied at the rate of 60 to 70 loads, equivalent to 25 to 30 tons, per acre. Strips were left unmanured, the plan being to estimate the effect of the manure on the yield of mangolds. Results will be recorded later, after harvesting of the crop.

Whether this process will develop or not is entirely a matter of cost, and that aspect is being investigated. At present we are satisfied that the straw rots satisfactorily if the right conditions for bacterial growth are obtained.

CORTICIUM-DISEASE OF POTATOES.

EXPERIMENTS IN CONTROL.

(Concluded.)

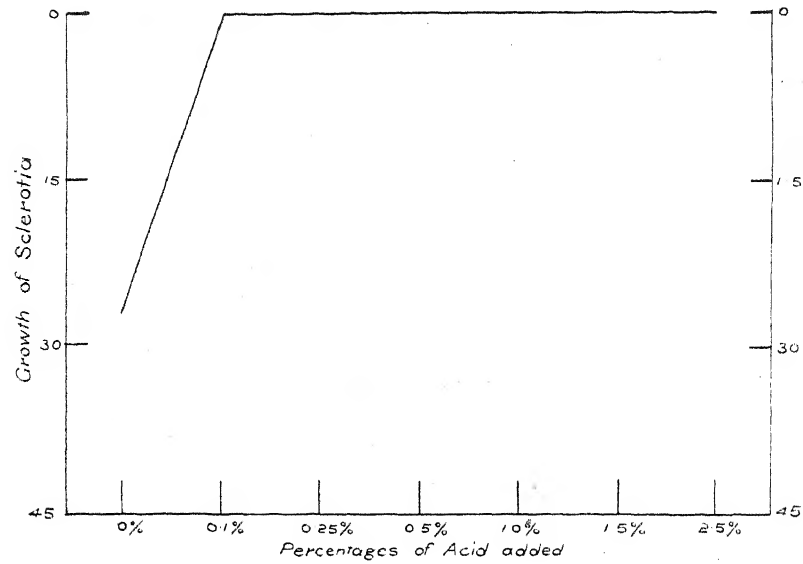
G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

IN a previous article (*Journal* for last month) it was shown that the standard treatments recommended for the control of corticium-disease, *Corticium vagum* var. *Solani* Burt, were not successful because they did not kill more than about 80 per cent. of the sclerotia present on the tubers treated. Numerous experiments were undertaken with a view to discovering some cheap and efficient means of killing these sclerotia, with the result that mercuric chloride, *when acidulated with hydrochloric acid*, was found completely to kill all sclerotia even at strengths much less than usually recommended.

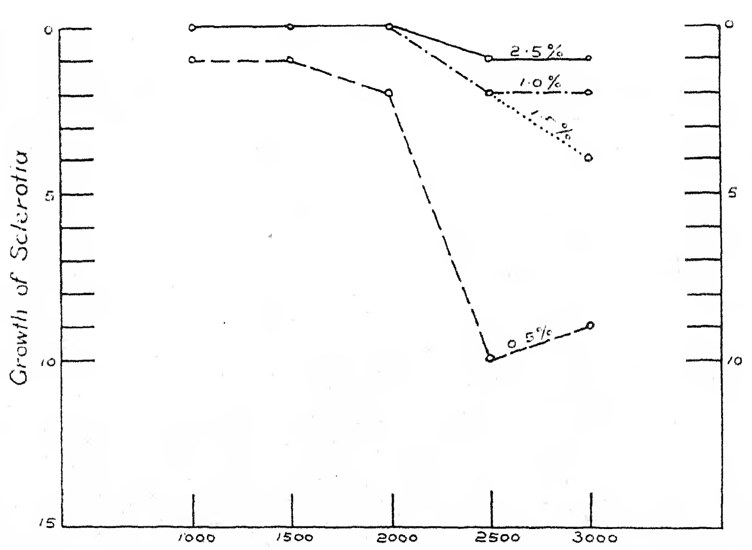
These experiments solved the problem in so far as the steep was concerned, so that there then remained the problem of cheapening the process in both material and labour. In regard to the latter factor, it is evident that a more practical method than the two-hour steep is necessary in dealing with the large quantity of seed tubers used by commercial growers. Therefore experiments were undertaken with a view to modifying the period of immersion.

For the smaller growers with a small quantity of seed to treat, it might be more practicable to place the tubers overnight in some suitable solution, to be ready for planting the following morning. Graph 7 shows that a solution of 1 part of mercuric chloride in 10,000 parts of water, when acidified with as little as 0·1 per cent. of hydrochloric acid, gives complete killing of all sclerotia, a result not obtained with an acid-free solution of this strength.

Further experiments were undertaken with a view to reducing the time of immersion to such an extent that treatment could be made a continuous process, thus making machine treatment feasible. The results finally obtained are shown in Graph 8. In this experiment tubers were immersed for five minutes in acidulated mercuric-chloride solutions of the following strengths: Mercuric chloride—1–1,000, 1–1,500, 1–2,000, 1–2,500, 1–3,000; hydrochloric acid—0·5 per cent., 1 per cent.,



GRAPH 7. SHOWING EFFECTS, AFTER SIXTEEN HOURS' IMMERSION, OF DIFFERENT PERCENTAGES OF ACID (H CL) ON THE KILLING-PROPERTIES OF 1—10,000 MERCURIC-CHLORIDE SOLUTIONS.



GRAPH 8. SHOWING EFFECTS, AFTER FIVE MINUTES' IMMERSION, OF DIFFERENT PERCENTAGES OF ACID WHEN ADDED TO SOLUTIONS OF MERCURIC CHLORIDE.

The curves represent percentage strengths of acid.

1·5 per cent., 2·5 per cent. After treatment the tubers were placed in a heap and covered with a sack wetted with 1–3,000 mercuric chloride. They were left overnight and the sclerotia plated out in the morning.

Graph 8 shows that this treatment resulted in the death of all sclerotia taken from those tubers which had been immersed in 1–1,000 and 1–1,500 solutions to which had been added 1, 1·5, and 2·5 per cent. of hydrochloric acid. This reduction in time required for treatment allows of the treatment of tubers in large quantities by the use of a mechanical device whereby tubers may be carried on a conveyer through the solution and transported to the drying-floor.

DIRECTIONS FOR TREATMENT.

Overnight Treatment.—Procure a wooden or concrete (not metal) tub or trough and fill with Solution A (see below). Place the tubers in this solution, being careful to have sufficient liquid present to cover all to a depth of at least 3 in. Leave the tubers in overnight, and in the morning remove and either immediately plant or dry and store until required. The time of immersion (sixteen hours) is merely an arbitrary one, as equal results will be obtained whether the tubers are left in the solution for twelve or twenty-four hours.

Five-minute Treatment.—Prepare solution in the same way as in the previous treatment, but use instead Solution B (see below). Leave in for at least five minutes (longer periods than this will have no detrimental effect upon the tubers) and remove to a floor, where the tubers should be piled in heaps and covered with sacking dipped in the same solution. Leave the heap covered for from sixteen to twenty-four hours, and either plant immediately or dry and store until required.

SOLUTIONS.

Solution A, Sixteen-hour Treatment.— Stock solution: Mercuric chloride, 50 grams ($1\frac{3}{4}$ oz. approx.); hydrochloric acid (conc.), $\frac{1}{2}$ litre ($\frac{7}{8}$ pint approx.). This quantity of stock solution contains sufficient to make 110 gallons of steep. For smaller quantities add 1 fluid ounce of the stock solution to 12 gallons of water.

Solution B, Five-minute Treatment.— Stock solution: Mercuric chloride, 200 grams (7 oz.); hydrochloric acid (conc.), 2 litres ($3\frac{1}{2}$ pints). This quantity of stock solution is sufficient to make 66 gallons of steep. For smaller quantities add 1 pint of stock solution to 19 gallons of water. After treatment with A the solution should be discarded; Solution B may be used three or four times before being discarded. As these solutions are corrosive and very poisonous they should be handled with care and kept away from children or stock. The use of metal implements should be avoided, as they will become corroded if allowed to come in contact with these solutions.

The mercuric chloride used should be of good quality, and the hydrochloric acid of commercial concentrated standard (31 per cent.). The cost of these substances is comparatively low, mercuric chloride being 6s. per pound, and hydrochloric acid 7s. 6d. per "winchester" of 10 lb. Thus the cost of the material required to prepare 66 gallons of Solution B is 7s. 8d., and that of Solution A 1s. 2d.

FUTURE WORK.

Further work is required to determine (1) the effects of treatments upon the tubers, and (2) the detrimental effects of the disease upon the yield. With regard to (1), it may be stated that all tubers were kept after treatment, and the production of shoots noted. In all cases where the tubers had well-developed shoots these were killed back to the tuber; but in the course of a few days further shoots developed in abundance, save in those cases where the solutions used had been acidified with 2·5 per cent. hydrochloric acid. With these, delay of a fortnight was evident, and with tubers which had been cut prior to immersion death was not infrequent. It is hoped next season to be able to carry out an extensive series of field experiments, with a view to solving these two last problems.

The writer is indebted to Mr. J. C. Neill, of this Laboratory, for assistance rendered during the course of the experiments.

CONCRETE-WORK ON THE FARM.

A. W. HUDSON, B.Ag., Assistant Instructor in Agriculture, Christchurch.

THE advantages of concrete-structure on the farm are now generally recognized, but practical knowledge of the technique of the work is often lacking among farmers. In a series of articles—now commenced—the writer proposes to give sufficient detailed information to enable any handy man to undertake the simpler structures or operations. The present instalment deals (1) with the general subject of materials, and (2) with the making of concrete posts. In subsequent articles it is proposed to treat similarly some other uses to which concrete can be put on the farm.

1. MATERIALS AND THEIR PREPARATION.

The materials used in making concrete are the "aggregate," cement, and water.

The aggregate may be natural shingle, broken shingle, crushed rock, sand, or a combination of these. It should consist of well-graded material—that is, material of all sizes between the largest stones allowed and sand. The material most commonly used is pit, river-bed, or beach shingle, and great care must be taken that there is neither clay nor vegetable matter present. If the shingle contains any soil or plant debris it must be washed free of these. A convenient form of trough for this purpose is shown in Fig. 1. The aggregate is placed in the trough and stirred thoroughly while water is run through. The lighter clay or soil particles or vegetable matter are carried out at the overflow notch.

The maximum size of stones allowed in the aggregate will depend on the nature of the work. For ordinary fencing-posts and troughs the largest stones should pass through a ¾-in.-mesh screen. For posts above 8 in. by 8 in. larger stones may be allowed, but should not be larger than will pass through a screen of 1½ in. mesh. Floors and

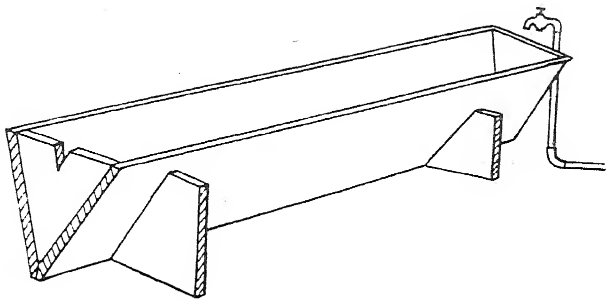


FIG. 1. TYPE OF TROUGH SUITABLE FOR WASHING SHINGLE.

paths permit the use of large shingle if their thickness is greater than about 2 in., but in general large material is not to be recommended. Where pit or river-bed shingle is used it will generally be necessary to screen the material. This may well be done at the pit or other place where the shingle is obtained, and the type of screen shown in Figs. 2 and 3 will be found very useful It may be propped up on the tail-board of a dray so that the material passing through the meshes of the screen will fall into the dray and the coarse stones back to the ground. Carting of unneeded material is thereby avoided. The wire for such a screen is obtainable already prepared at wireworking establishments.

Cement.—This must be of good quality, and must not have suffered exposure to damp. Since it is often difficult to store any quantity under the driest of conditions, it is advisable to get only as much as may be used up in a few months.

Water.—It is necessary that water should be free from acid, alkali, clay, or vegetable matter.

PROPORTIONS OF MATERIALS.

A weaker mixture than 1–6—one part of cement to six of aggregate —should not be used, except where the work is not likely to be subjected to severe strain or wear, such as in the case of bulky walls, where 1–8 can be safely employed. When washed shingle or crushed stone is used, clean, *coarse* sand in the proportion of about one of sand to two of stone must be added. This will not increase the space occupied by the stone very much, as it must be borne in mind that the sand goes to fill up the spaces among the coarse material.

Measuring of Quantities.—On the farm, measurement of quantities is most conveniently done with a kerosene or petrol tin, which holds about two-thirds of 1 cubic foot of material. A bag of cement contains $1\frac{1}{3}$ cub. ft., and therefore about two kerosene-tinfuls. The volume of the work should be measured; this will be the measure of the quantity of aggregate required (the addition of the cement to the shingle does not increase the total bulk, as the cement goes to fill up the finer spaces in the material). Suppose the volume of concrete required is 4 cub. ft.: since a kerosene-tin holds about two-thirds of 1 cub. ft., six tins of aggregate will be required. (In practice it is generally found

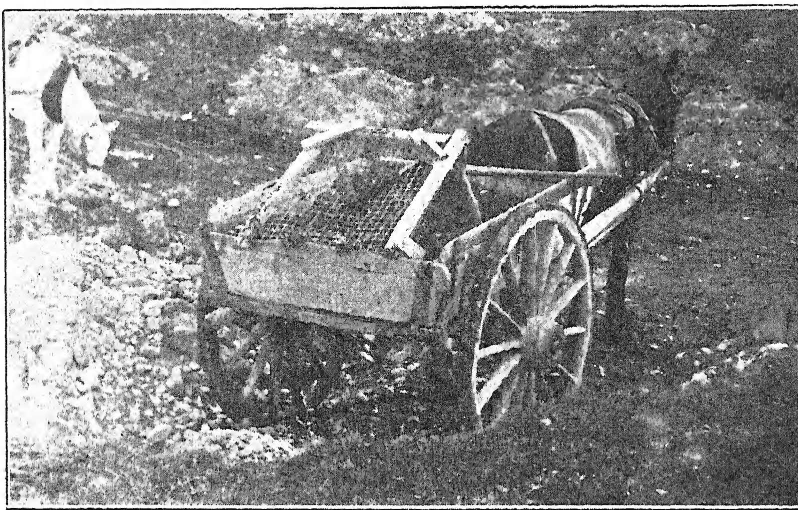


FIG. 2. METHOD OF SCREENING SHINGLE AT PIT.

Suggested dimensions for a screen such as shown are given in Fig. 3.

[*Photo by A. W. Hudson.*

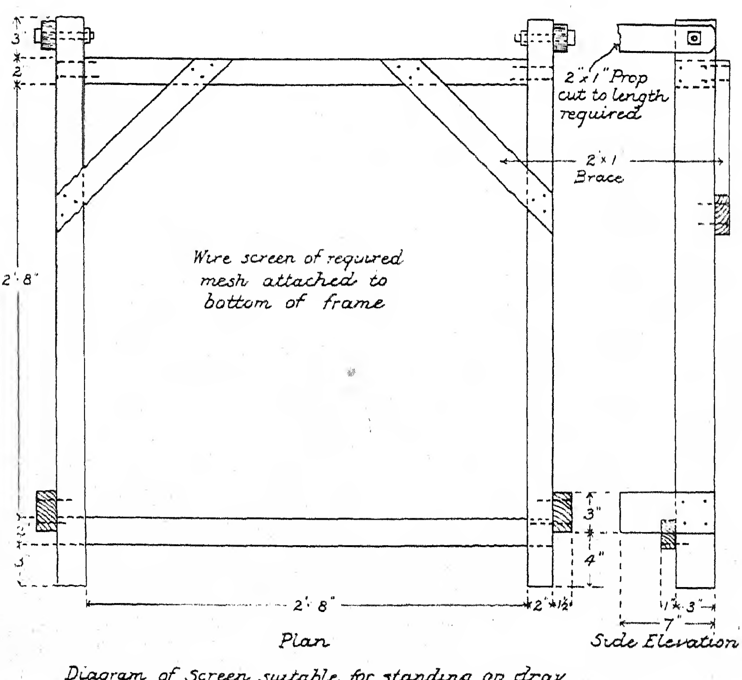


FIG. 3.

that in a case similar to the foregoing about six and a half tinfuls will be required. This is due to the fact that the material does not become completely packed when just thrown into the tin. A little practice will allow a very accurate estimate of the required quantity to be made.) Having measured the shingle or other aggregate, a measured quantity of cement is then emptied on the top of the heap so that it runs evenly all over it. In the example six tinfuls of the aggregate were taken, and therefore, if the mixture is to be 1–6, one tinful of cement will be required.

Mixing.—A mixing-board 8 ft. by 8 ft. square is suitable for anything up to eight tinfuls at a time. It should be made of tongued-and-grooved Oregon-pine boards, this timber being most suitable for all concrete moulds, &c., as it is less liable to warp than others. Where there is no need to shift the mixing-board a smooth concrete floor makes a very good substitute. Mix thoroughly before and after adding the water. The best mixing is obtained by having a man on each side of the heap. Shovel from the bottom, and throw the material away from the heap with a turn of the shovel, at the same time imparting a spreading movement. Turn the material in this manner at least three times before adding water. A drag with flattened tines is a very useful tool for mixing, and if its use is alternated with that of the shovel the work will be made easier. Repeat the turning operations, at the same time splashing water carefully over the new heap being formed, or using a watering-can. The water must not be added so quickly as to cause streamlets to run away from the heap, as a large amount of cement may be lost if this happens. The quantity of water necessary depends upon the wetness of the aggregate before mixing. Excess of water must be avoided, and when the concrete is so wet as to require a slight shake to dislodge it from the shovel the wetness will be right for most purposes.

So that the concrete can be used immediately, the mould must be got in readiness before mixing.

2. CONCRETE POSTS.

ORDINARY FENCING-POSTS.

Making the necessary moulds is, of course, the first step in connection with concrete posts. Drawings of a mould suitable for making tapering posts, 6 ft. long, 5 in. by 5 in. at the bottom and 5 in. by 3 in. at the top, are given in Fig. 4. This type of boxing can be used equally well for the post with parallel sides similar to that made in the mould shown in Fig. 5, or a two- or six-post mould may be preferred. If it is considered preferable to make the posts singly—as when larger posts, say, 8 in. by 8 in. in cross-section, are being prepared—then the Figs. 6 and 7 type is extremely useful. Instead of the dowels, strips may be fastened on the base-board to keep the sides from bulging; or two iron pins passing through holes in a cross-piece which rests on the top of the mould, fitting into holes in the base-board, make a very convenient arrangement for this purpose (Fig. 6). Since the dowel-holes tend to become filled with cement, this method of holding the mould in position is probably the better one.

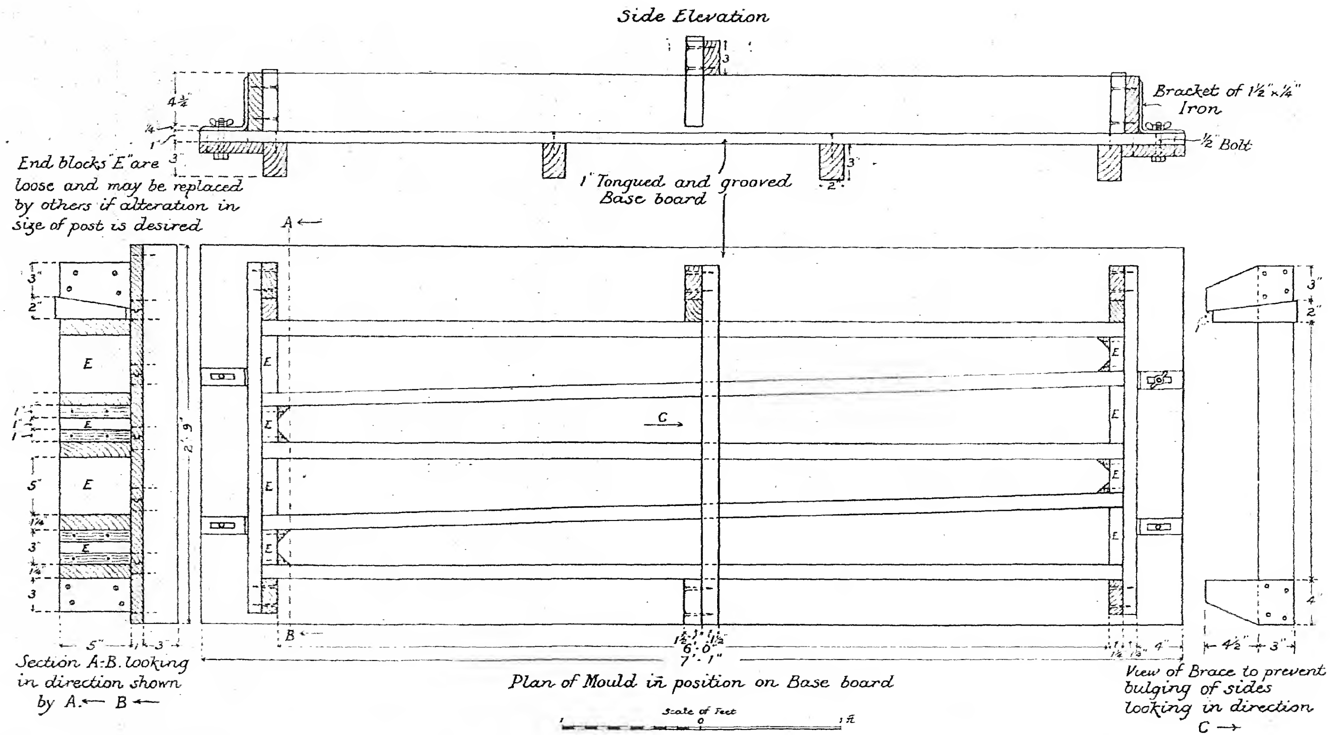


Diagram of Mould & Base board for making Posts 6' long, 5"×5" bottom and 5"×3" top.

Timber:—Dressed Oregon Pine. Measurements refer to the size of timber in the rough state.

FIG. 4.

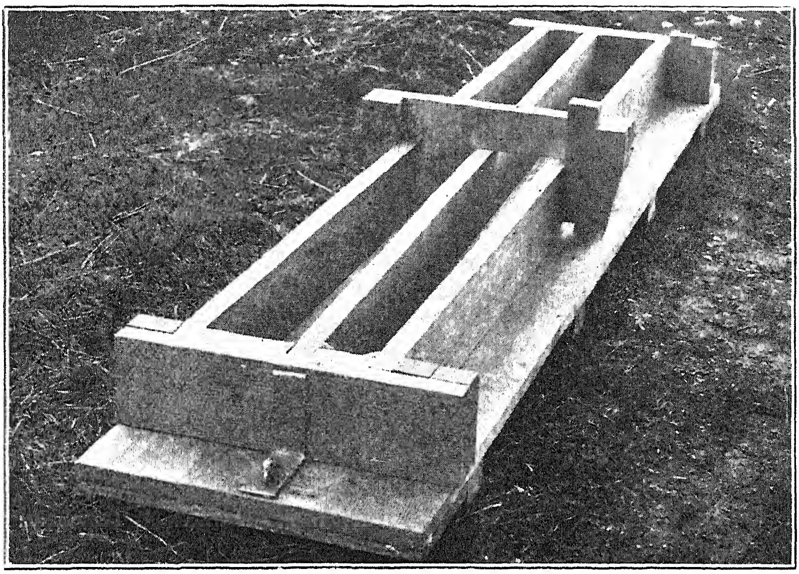


FIG. 5. TWO-POST MOULD OF SIMILAR DESIGN TO THAT GIVEN FOR THE FOUR-POST MOULD (FIG. 4).

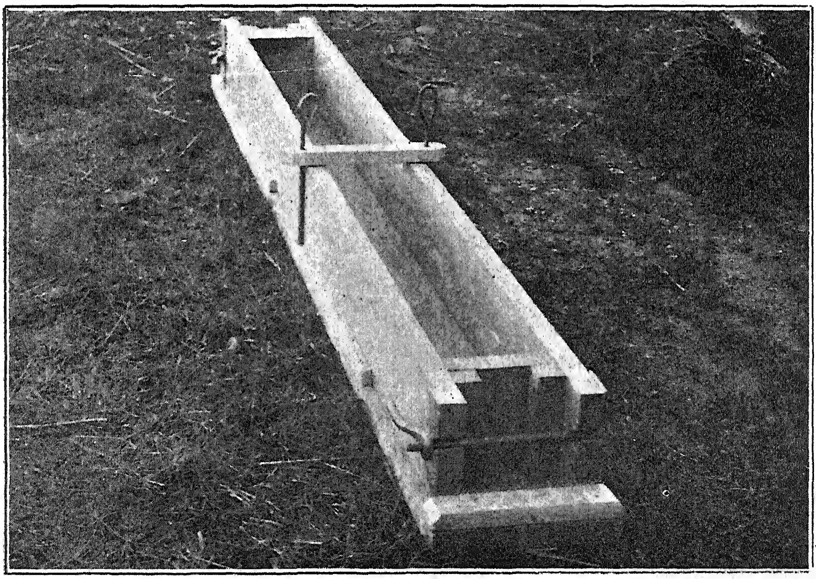


FIG. 6. MOULD SIMILAR TO THAT SHOWN IN FIG. 7 (SEE NEXT PAGE), BUT WITH CLEATS AND IRON PINS INSTEAD OF DOWELS.

[*Photos by A. W. Hudson.*

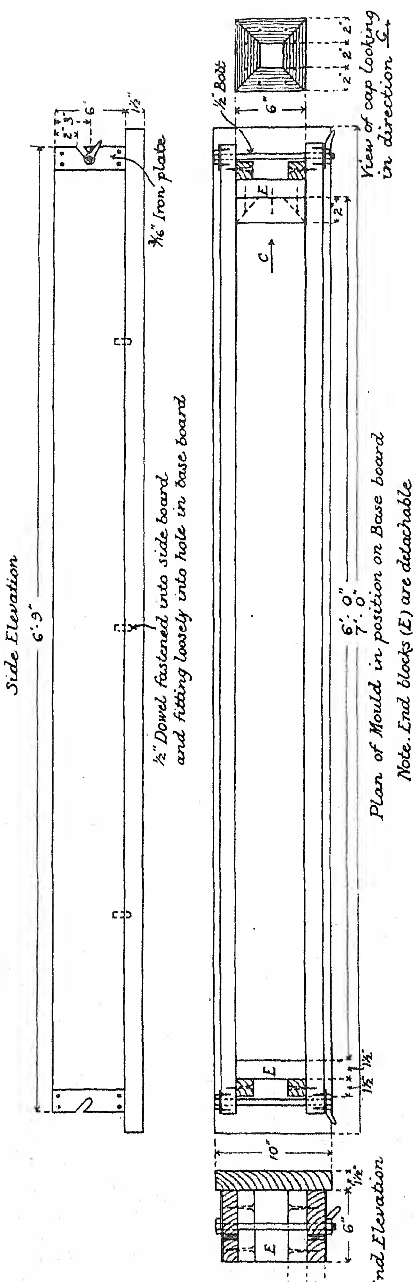


Diagram of Mould and Base board suitable for making Posts 6' × 6" × 6".

Timber:- Dressed Oregon Pine. Dimensions given are those of timber before dressing.

FIG. 7.

Method of Preparing and Filling Moulds.

Cover the base-board with a sheet of plain galvanized iron, or with paper, or paint with any one of the following: (1) Waste oil (such as that from the crank-case of an engine); (2) clay and water made into a pasty solution; (3) whitewash. The portion of the mould coming in contact with the concrete must then be painted with any of these materials and placed in position on the base-board. Wet the mixture, and mix it thoroughly. Lay about 1 in. of concrete in the bottom of the mould, and tamp with a wooden rammer similar to that shown in Fig. 8. Next place two reinforcing-rods (previously prepared) with about 1 in. or 2 in. of their ends bent at right angles, and extending to within about ½ in. of the ends of the mould, on the thin layer of concrete (for position of reinforcing-rods see Fig. 9—important). Now

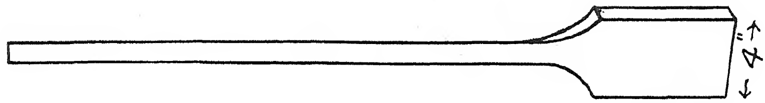


FIG. 8. TYPE OF RAMMER RECOMMENDED FOR MAKING POSTS.

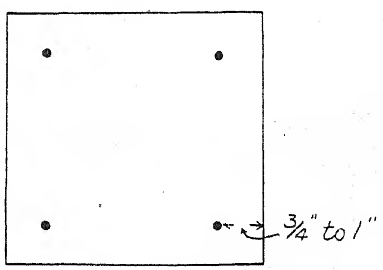


FIG. 9. TRANSVERSE SECTION OF POST, SHOWING POSITION OF REINFORCING-RODS.

fill the moulds to within about ¾ in. of the top, being careful to tamp thoroughly as the concrete is put in in thin layers. Place two other reinforcing-rods in position with the bent-over ends turned towards the centre of the post, fill in to the top of the mould, and finish the surface with a trowel.

The next operation is to fix in the wire staples shown in Fig. 10, so that the end with the double loop protrudes about ½ in. This must be done immediately the concrete is in position, and fine material carefully tamped around the staples. A rod of wood marked with the required spacing will serve as a guide to the position of the staples.

In addition to the wire staples, holes through the post should be provided, because the life of the staples is limited, and when they rust away the post is likely to be better than ever. These holes may be made in the desired position by placing ¼ in. iron rods through the mould

from side to side before the concrete is put in. The rods must be removed before the concrete hardens, usually about two hours after placing it in the moulds. This method cannot be adopted in making tapering posts unless no more than two posts are made in the one mould.

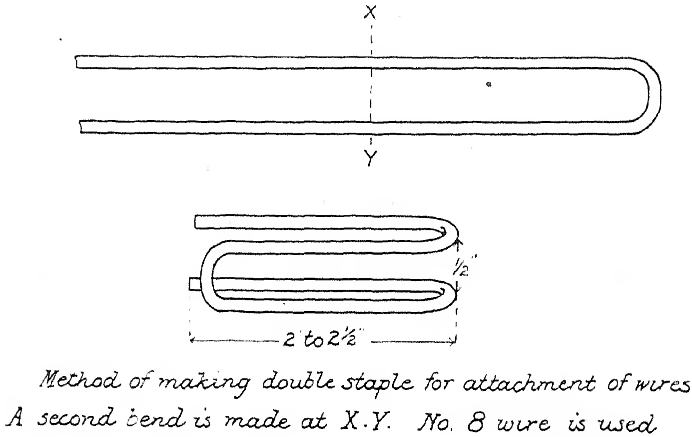


FIG. 10.

Removal of Moulds.

The moulds may be removed about three or four hours after the concrete has been laid. The method adopted at Lincoln College, where the type of boxing shown in Fig. 4 is used, is as follows: The end boards and blocks and outside boards are first removed; then two parallel boards attached by iron hoops (Fig. 11) are placed so that they lie along the edges of two adjacent posts and astride the dividing-board of the mould. The boards are held firmly, but without undue pressure, and by means of a tool such as a screwdriver the ends of the dividing-board is levered up just a sufficient amount to allow a hooked iron rod to be placed under it. Keeping the parallel board firmly in position, the dividing-board is then lifted right up and removed. If this operation is not performed at about the time stated it will be necessary to leave the dividing-boards of the mould in

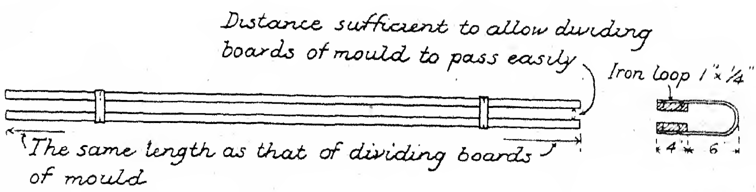


FIG. 11. PARALLEL BOARDS USED IN REMOVAL OF MOULD.

position until the posts themselves can be moved. On no account must the posts be moved until four or five days have elapsed. They may then be lifted carefully, supported in the middle as well as at the ends, and should be laid carefully on sand or loose earth unti mature. A stout plank makes a convenient carrier for the posts, and prevents any tendency for them to sag in the middle.

STRAINERS.

For a good strainer, which can be used also as a gate-post, the following is recommended: Type of mould as in Fig. 7; dimensions, 8 ft. by 8 in. by 8 in.; reinforced with $\frac{3}{8}$ in. or $\frac{1}{2}$ in. round iron. When the post is required as a strainer a notch to take the ends of the stays is made by bedding a wedge-shaped piece of wood of the required size into the face of the post as soon as it is moulded.

LARGE GATE-POSTS.

The mould for making these is shown in Fig. 12, and the method adopted in building one is as follows: The position in which the post is to stand is carefully determined. A hole, 3 ft. to 3 ft. 6 in. deep and about 16 in. square, is dug. The base of the mould is then set in position over the hole and carefully levelled. Reinforcing-rods of $\frac{1}{2}$ in. or $\frac{5}{8}$ in. iron, long enough to reach from the bottom of the hole to the top of the post, and which may be held at the correct distance apart by a wooden frame or by strong wire (the latter can be left attached to the rods) twisted round them, are next placed in the hole, and the concrete filled in to the top of the base. The mould proper is then placed in position and fastened to the base by means of the brackets and thumb-screws shown in the diagram: it is carefully plumbed and held firmly in position by two temporary stays connecting the mould with pegs firmly driven into the ground. While the mould is being filled the concrete should be well tamped with an oar-shaped rammer, especially around the sides. If this is done and there is sufficient sand in the aggregate a very smooth surface will result.

As soon as the mould is filled the cap is put on. This may be of any desired shape. The small drawing annexed to Fig. 12 gives dimensions for a pyramid-shaped cap, which is made two or three days before the post. Short wires are inserted into it, and when the cap is put in position these serve to tie it to the post. The cap-mould shown consists of a square frame with a pyramid-shaped mould (shown in section) within it. An alternative method of putting on the cap is to prepare a strong mixture (1–2 or 1–3) of cement and sand, which is made fairly stiff, and simply placed on top of the post and moulded into the desired shape. This is a slower method than the one first described.

The post-mould may be removed with safety in about two days, and if the post is then painted over with pure cement mixed into a paste with water a very good finish will result. A pure-white cement may be procured for such work as this if a better appearance is desired.

The hinge fasteners which have given best results at Lincoln consist of a three-sided bracket with the ends rounded and threaded. The fourth side has two holes bored in it, and carries the hanger for the hinges. The threaded ends of the three-sided piece pass through

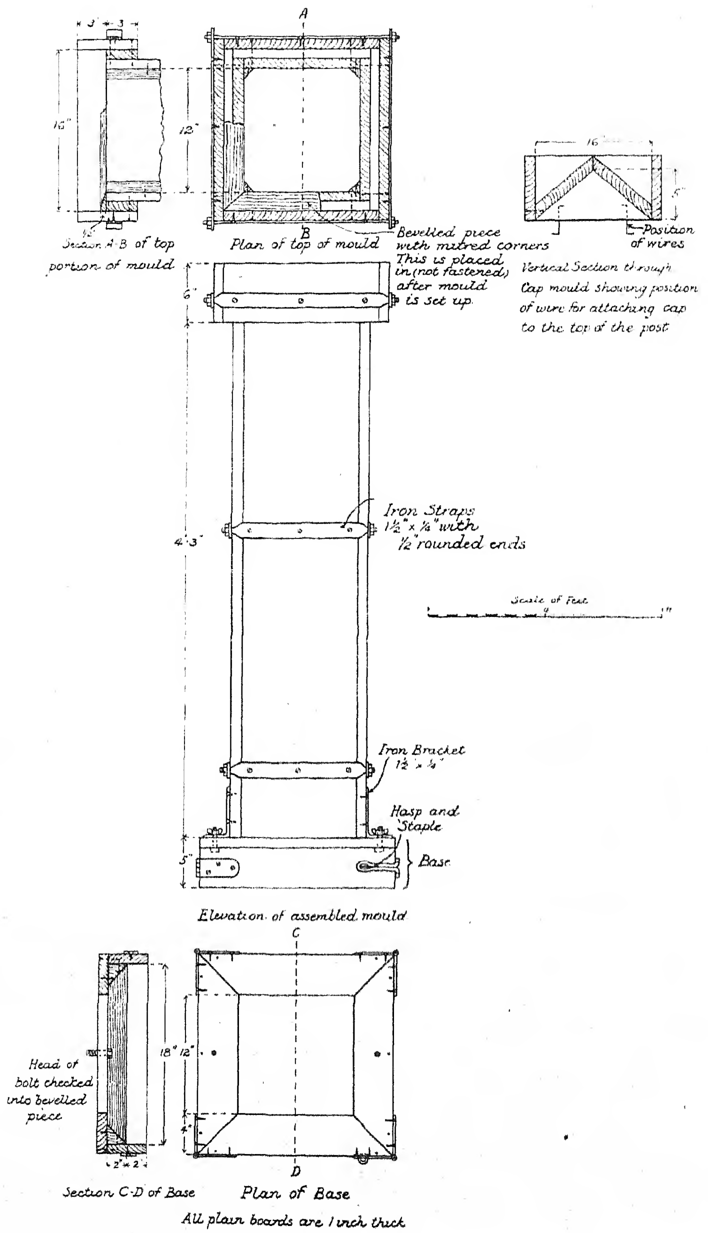


FIG. 12. MOULD FOR LARGE GATE-POST.

the holes, and the whole is fastened securely by nuts (Fig. 13). The type of gate-fastener to be used should be decided on beforehand, and a hole made in the boxing for its insertion.

STAYS.

Stays may be made any size. Those used at Lincoln are 8 ft. long and 4 in. by 2 in. in cross-section, and reinforced with two pieces of No. 6 wire near the top and bottom edges. Two are used, placed side by side and ½ in. apart. The fence-wires pass between them and are then fastened round the post (see Fig. 14).

It is a good plan to have a few old kerosene-tins on hand whenever mixing is being done. If there is any surplus material it can be put into such tins, and the blocks formed used to butt the stays against.

BEVELLING.

It is good practice to bevel the corners of posts, so that if they are struck the possibility of a piece being chipped out is lessened, and a heavy blow, unless striking the post squarely, would more easily glance off. Bevelled strips can be placed in the mould for the bottom corners of the post, and a trowel may be used to bevel the corners lying uppermost.

SEASONING OF POSTS.

Posts, and indeed any concrete - work, should be dried slowly. Therefore keep posts covered with wetted bags or other material for about two weeks, and even after this the drying must be slow. From three to six months must be allowed before the posts are used.

Concrete-work must be protected from extremes of heat and cold. If protection cannot be provided no attempt should be made to work in very hot or in frosty weather.

REINFORCING.

Reinforcing-material may be used as follows :—

Tapering posts (Figs. 4 and 16) ..	Four rods of No. 6 wire or ¼ in. round iron.
6 in. by 6 in. posts (Figs. 6 and 15)	Four rods of ¼ in. or ⅜ in. round iron.
8 in. by 8 in. post	Four rods of ⅜ in. or ½ in. round iron.
12 in. by 12 in. gate-post ..	Four rods of ½ in. or ⅝ in. round iron.

The reinforcing-rods must run nearly the full length of the posts.

FENCES.

The fence shown in Fig. 15 is constructed of 6 in. by 6 in. posts placed about 1 chain apart. Wooden droppers are fastened to the wires about every 6 ft. The spacing of the wires is approximately as follows: From the top of post to barbed wire, 3 in.; from barbed wire to first plain wire, 10 in.; from first plain wire to second plain wire, 7 in.; from second plain wire to third plain wire, 6 in.; from third plain wire to fourth plain wire, 5 in.; from fourth plain wire to fifth plain wire, 5 in.; from fifth plain wire to sixth plain wire, 5 in.; from sixth plain wire to ground-level, 5 in. This fence may be considered suitable for holding any kind of ordinary stock. The droppers are hung so as to clear the ground, and the fence swings on any attempt being made to get through it. This is generally sufficient to frighten stock away.

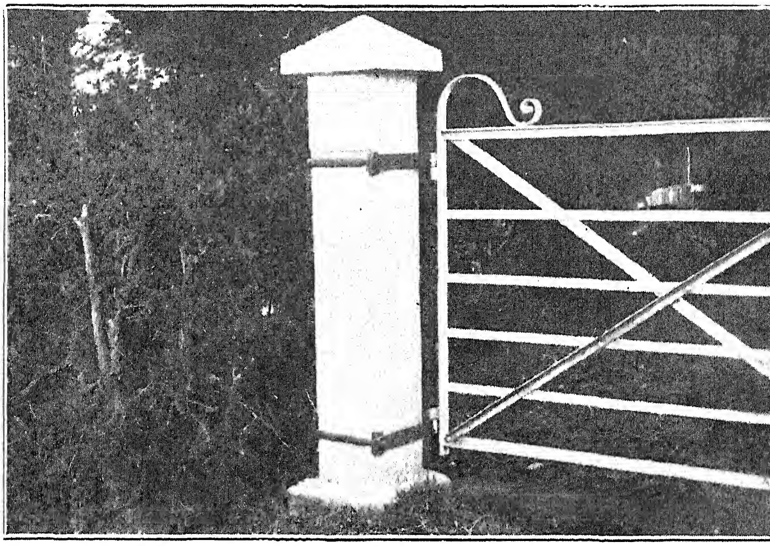


FIG. 13. 12 IN. BY 12 IN. GATE-POST MADE IN A MOULD VERY SIMILAR TO THAT OF FIG. 12.

Note method of hanging the gate.

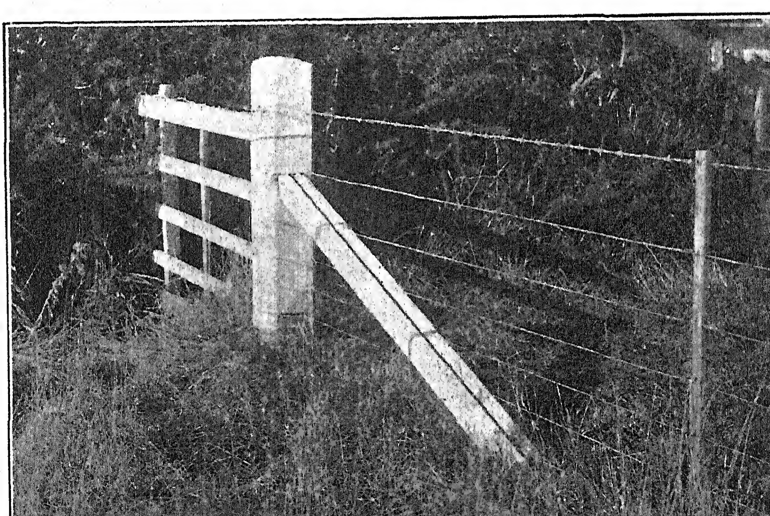


FIG. 14. 8 IN. BY 8 IN. STRAINING-POST, SHOWING METHOD OF USING DOUBLE STAYS OF 4 IN. BY 2 IN. REINFORCED CONCRETE, WITH FENCE-WIRES PASSING BETWEEN.

[*Photos by A. W. Hudson.*

FIG. 15. SWING FENCE, WITH POSTS 6 IN. BY 6 IN. IN CROSS-SECTION, 1 CHAIN APART, AND 2 IN. BY 1 IN. WOODEN DROPPERS EVERY 6 FT.

[*Photo by F. E. Ward.*

The tapering posts (Fig. 16) are placed much closer than in the fence just described. Their distance apart is from 5 yards to 6 yards, with droppers between. They cannot be recommended for horse or cattle fences unless more strongly reinforced. Half a chain should not be too great a distance between such posts where the fence is intended for sheep.

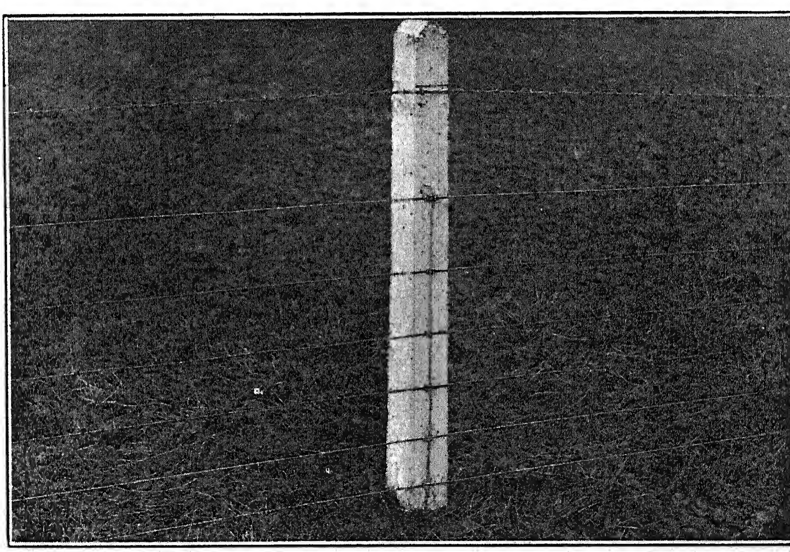


FIG. 16. TAPERING POST.

Note method of fastening the wires. Each fence-wire passes through the loop of the "staple" (see Fig. 10), and is held in position by a No. 8 wire dropper which passes through the loops.

[*Photo by A. W. Hudson.*

TIMBER REQUIRED FOR MOULDS.

Portion of Mould for which required.	Dimensions of Cross-section.	Number of Pieces required.	Length of each Piece.	Total Length.	Number of Superficial Feet.
(1.) For Mould shown in Fig. 4.					
	Inches.		Ft. in.	Ft.	
Bearers of base-board and brace (not necessarily dressed)	3 x 2	5	2 9	14	7
Long boards of mould	6 x $1\frac{1}{2}$	5	6 0	40	30
End boards and blocks (off-cuts here will make stops for ends of brace)	6 x $1\frac{1}{2}$	4	2 6	..	..
Tongued-and-grooved base-boards ..	6 x 1	6	7 0	42	21
Total superficial feet	..	..	..	..	58
(2.) For Mould shown in Fig. 7.					
Side boards and end blocks	6 x $1\frac{1}{2}$	2	8	16	12
Base-board	10 x $1\frac{1}{2}$	1	7	7	$10\frac{3}{4}$
Total superficial feet	..	..	..	..	$22\frac{3}{4}$
(3.) For Single Mould to make 8 in. by 8 in. Strainer or Gate Post.					
Side boards and end blocks	8 x $1\frac{1}{2}$	2	20	20	20
Base-board	12 x $1\frac{1}{2}$	1	9	9	$13\frac{1}{2}$
Total superficial feet	..	..	..	..	$33\frac{1}{2}$

In estimating quantities it will be seen that in the case of material for mould Fig. 4 standard sizes of timber have been allowed for: *e.g.*, instead of 5 in. by $1\frac{1}{4}$ in. for the long boards and ends of mould, 6 in. by $1\frac{1}{2}$ in. is reckoned on. Tongued-and-grooved boards are not sold by the superficial foot, but by the "running" foot. This will affect the calculation of cost very slightly.

COST OF TAPERING POST AS MADE IN MOULD SHOWN IN FIG. 4.

Mould.

Dressed Oregon pine (first class) costs at the present time about £3 per 100 superficial feet.

	£	s.	d.
58 sup. ft. at £3 per 100	1	14	10
Four iron brackets and bolts, with thumb-screw and wood screws ..	0	10	0
Cost of labour for making..	0	10	0
Total cost of boxing	£2	14	10

Assuming that such a mould can be used one hundred times, the cost allocated to each post will be 54s. divided by 400, or just over $1\frac{1}{2}$d. A mould well cared for and kept under cover when not in use will give considerably more service than the figure given. At Lincoln some moulds have been in use off and on for a period of twelve years.

Concrete-work.

It is here assumed that shingle costs the farmer 10s. per yard. Considering that such work as carting can be done when horses cannot

be used on the land, it seems hardly fair to charge even this amount. In any case a little consideration will show that even if the cost of shingle is twice the amount stated the increase in the cost of the post will not be great.

Cement and shingle: 1 yard of shingle is sufficient for making thirty-two tapering posts. Cement costs about 7s. 3d. per bag at main centres.

	£	s.	d.
1 yard shingle	0	10	0
3½ bags cement (1–6 mixture)	1	5	4
For thirty-two posts	£1	15	4

The cost of cement and shingle for one post equals 1s. 1¼d.

Reinforcing: 1 cwt. No. 6 galvanized wire costs 25s. There are about 383 yards in 1 cwt.; therefore 1 ft. costs about ¼d., and 24 ft. (amount required for one post) 6d.

Labour: With three sets of six-post moulds three men can make eighteen posts in half a day. Allowing 12s. per day per man, the cost of labour per post is 1s.

Summary of Cost.

Mould, to be charged per post, 1½d.; cement and shingle, 1s. 1¼d.; reinforcing, 6d.; labour, 1s: total cost per post, 2s. 8¾d. This does not allow for removal and clearing of moulds, which involves only a small amount of labour.

COST OF 6 FT. BY 6 IN. BY 6 IN. POST (FIG. 7).

Mould.

	£	s.	d.
22¾ sup. ft. at £3 per 100	0	13	8
Iron plates and bolts	0	7	6
Labour for making	0	5	0
Total cost of mould	£1	6	2

If used one hundred times, the cost to be charged per post is 3d.

Concrete-work.

Cement and shingle: 1 yard of shingle will make eighteen of these posts.

	£	s.	d.
1 yard shingle	0	10	0
3½ bags cement	1	5	4
For eighteen posts	£1	15	4

Cost of cement and shingle for one post, 2s.

Reinforcing: ⅜ in. round iron, 24s. per cwt.; 1 cwt. approximately 300 ft.; therefore cost of 1 ft. is 1d. approximately, and 24 ft. costs 2s.

Labour: Three men can make twelve posts in half a day; at 12s. per day per man, the cost of labour per post is 1s. 6d.

Summary of Cost.

Mould to be charged, per post, 3d.; cement and shingle, per post, 2s.; reinforcing, per post, 2s.; labour, per post, 1s. 6d.: total cost of post, 5s. 9d.

COST OF 8 FT. BY 8 IN. BY 8 IN. STRAINER-POST.

Mould.

	£	s.	d.
$33\frac{1}{2}$ sup. ft. at £3 per 100	1	0	0
Iron plates and bolts	0	7	6
Labour for making	0	5	0
Total cost of mould	£1	12	6

If used one hundred times, cost to be charged per post is 4d.

Concrete-work.

Cement and shingle: 1 yard of shingle will make about seven and a half posts. 1 yard shingle and $3\frac{1}{2}$ bags cement cost £1 15s. 4d.; therefore cost of cement and shingle per post is 4s. 9d. approximately.

Reinforcing: $\frac{1}{2}$ in. round iron at 22s. 6d. per cwt.; 1 cwt. = 171 ft.; therefore cost of 1 ft. = $1\frac{3}{5}$d., and 32 ft. = 4s. 3d.

Labour: Three men can make six posts (probably more) in half a day. The cost of labour per post is thus 3s.

Summary of Cost.

Mould, per post, 4d.; cement and shingle, 4s. 9d.; reinforcing, 4s. 3d.; labour, 3s.: total cost of post, 12s. 4d.

COST OF 12 IN. BY 12 IN. GATE-POST (FIG. 12).

Mould.

This cost must necessarily be approximate only, because only one or two such moulds would be required, and for the purchase of small quantities of timber of suitable dimensions the cost would undoubtedly be greater in proportion than if a large amount was ordered.

	£	s.	d.
About 30 sup. ft., say	1	0	0
Iron straps, hinges, &c.	1	0	0
Labour	0	15	0
Total	£2	15	0

Concrete-work.

In this case the position in which the post will stand must determine the labour required in getting material to the spot. Therefore only the actual cost of shingle, cement, and reinforcing is shown. Also it must be remembered that the post is built in position, so that the labour of placing it occurs during the making. If a hole 3 ft. 6 in. deep and 18 in. square is made, about $\frac{1}{2}$ yard of shingle is necessary.

	£	s.	d.
$\frac{1}{2}$ yard shingle	0	5	0
About $1\frac{2}{3}$ bags cement at 7s. 3d.	0	12	0
Four reinforcing-rods, 9 ft. long, $\frac{5}{8}$ in. diameter ..	0	7	4
	£1	4	4

(To be continued.)

AMERICAN FOUL-BROOD IN BEES AND ITS TREATMENT.

E. A. EARP, Senior Apiary Instructor, and G. V. WESTBROOKE, Apiary Instructor.

FOUL-BROOD is the name given to certain diseases which attack bees in the brood or larval stage. American investigators have determined three types of foul-brood, of which the most destructive to bees in this country is that caused by *Bacillus larvæ* (White), and named American foul-brood. No investigations have yet taken place to determine the possible presence of the other two brood diseases—European foul-brood, caused by *Bacillus pluton,* or sac-brood, caused by a filterable virus. Almost every season beekeepers note and report diseased conditions of the brood of which they have no knowledge, and which differ from the usual appearance of the brood when attacked by *Bacillus larvae*. These cases are not serious, as they are never reported in epidemic form, the colonies generally regaining form during the summer.

Since foul-brood causes a large annual loss of colonies and the destruction of an extensive amount of beekeeping equipment, it may be considered a very serious menace to honey-production in the Dominion. Greater efforts are now being made to control its spread through education and a more rigid enforcement of the Apiaries Act. The disease is found in the North and South Islands. Although certain areas have been rendered free from it, how long they will remain so will depend upon whether diseased colonies or infected material are introduced. The rapidity with which the disease spreads from place to place tends to dishearten beekeepers, and it is only by constant vigilance and the application of precautionary and curative measures that immunity from the dread disease can be won.

The precise date at which foul-brood made its appearance in New Zealand is not known. For some years prior to 1907 beekeepers were troubled with serious losses among their bees, and in that year samples of comb submitted to the United States Department of Agriculture for examination were reported upon as showing the gross characteristics of American foul-brood.

CAUSE AND SYMPTOMS.

The disease invades the colony by attacking the young larvæ during the time when they are being fed by the nurse bees, and the infected larvæ usually die just after the cells are capped over. The bees allow the resulting matter to remain there, and the number of hatching-bees decreases in proportion to the increase in the number of affected cells. Larvæ of the queen, worker, and drone may become infected, although the worker larvæ are more frequently affected by the disease. Adult bees are immune. The life of the worker bee is estimated in the summer at from six to eight weeks, and it is natural to find that as the disease advances the colony dwindles in numbers until it eventually dies out. The honey that is left in the combs is carried away by bees from other colonies, which also become infected and eventually die.

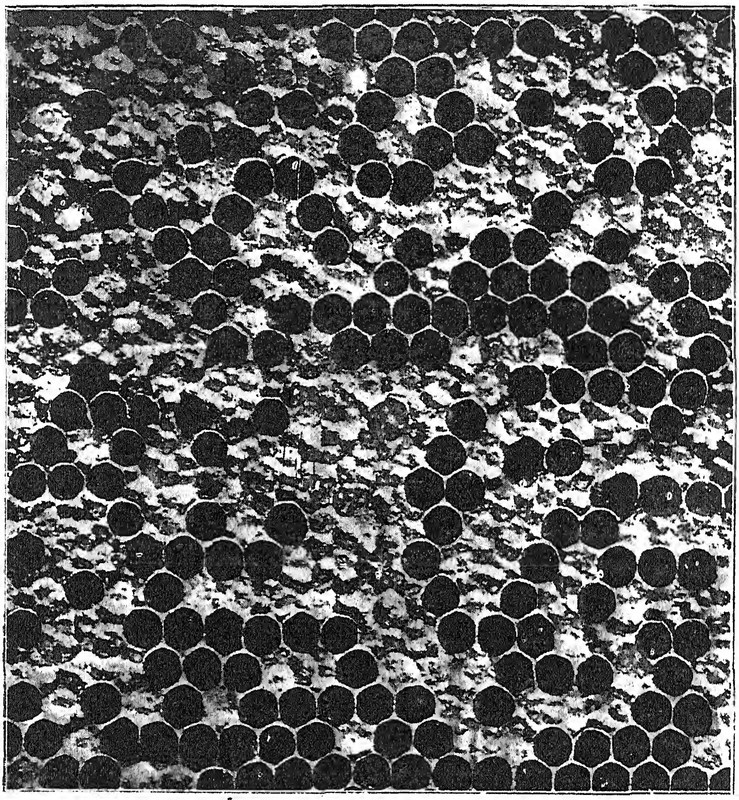


FIG. 1. PORTION OF COMB INFECTED WITH FOUL-BROOD. NATURAL SIZE.

Foul-brood is usually brought into the hive in the honey obtained from a previously infected source. The spore or bacillus finds its way into the alimentary canal of the larvæ along with the food or chyle, and at once begins to increase at an enormous rate until all the available nutriment for its development is used up. The larva in the early stages of the disease assumes an unnatural position. The colour also changes from a pearly-white to a dirty-yellow, and eventually to a dark-brown, sticky, putrid mass. During these stages the smell is usually of an objectionable character, resembling very closely the odour given off by hot glue. In cases where the larva has died after being capped over, the cappings are an indication of the disease contained in the cell. They will be found to be sunken or concave, dark in colour, greasy in appearance, and in some instances perforated. This, however, is not always the case. The cappings over the cells containing healthy brood are usually convex. A good queen lays her eggs in circles, and the fact of a single cell remaining unhatched is suspicious. If allowed to take its course the disease spreads rapidly to surrounding cells and combs, till finally no brood can hatch and the colony succumbs. On opening some of the cells a thin glue-like

coffee-coloured mass will be noticed, which on the insertion of a splinter of wood adheres to the point, and can be drawn rope-like for some little distance out of the cells. This is one of the most distinctive features of foul-brood prevalent in many countries, and, where present, it is considered conclusive evidence of the disease.

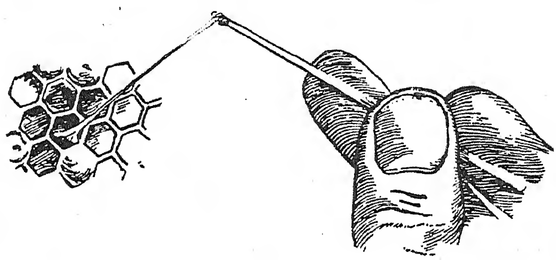


FIG. 2. SHOWING ROPY NATURE OF AMERICAN FOUL-BROOD.

[*U.S.A. Bulletin 442.*

Later on this glue-like substance dries up into the before-mentioned black, scale-like body. When the scale is scraped off and held to the nose a strong objectionable smell can be detected. Some beekeepers may fall into the mistake of supposing a colony to be clean when there is no objectionable odour, but the foul-brood must be in an advanced stage before this is noticeable. It is through honey being put into these cells that it becomes a source of infection, and, however little disease there may be in a colony, the honey in the hive is liable to contain the germs of disease. Uncapped diseased cells may easily pass unnoticed, especially when the comb is empty and there are no capped cells to betray its presence. To detect the disease in such a case, stand with the sun shining over the shoulder from behind and hold the comb horizontally with the top bar towards the body. The light will strike on the lower side of the cells and will show up the dried scales of disease.

SOURCES OF INFECTION.

Foul-brood is highly infectious, and is spread chiefly by the robbing of diseased colonies, honey being the chief agency by which the disease is transmitted from colony to colony. When a diseased colony becomes too weak to defend its stores it is liable to be robbed out by bees from healthy colonies, and in this way the germs of disease are carried. The principal causes of infection may be stated as follows: (1) Healthy colonies robbing infected colonies; (2) the acquisition of infected swarms, colonies, hives, and appliances; (3) supplying bees with honey or combs from an infected colony; (4) indiscriminately manipulating first diseased and then healthy colonies without taking proper precautions to disinfect the appliances used.

BASIS OF TREATMENT.

Bees may be successfully treated during any period of the honey-flow, but the most desirable time is shortly after the beginning of the main flow. At this time there is little danger of robbing. In

the colder months, if diseased colonies are detected, the bees should be put on clean drawn-out combs, fed on warm syrup or frames of honey from a clean hive, and left until the spring. Although this operation may not effect a cure, it acts as a temporary check to the disease, and removes the possibility of an outbreak of the trouble being transmitted to other colonies should robbing take place. When this instruction is followed the colony requires to be marked for examination when the first spring work is undertaken.

Experience has proved the efficacy of the McEvoy treatment all the world over, and it is strongly recommended by this Department. When treating a colony it is necessary that there be sufficient bees to form an average-sized swarm. Where the disease is so far advanced as to have left few bees in the hive, then it would be safest to destroy the bees and bee-combs by fire. Tinkering with such a colony would be both useless and dangerous.

Preferably the treatment should be done in the evening, but this is not always possible. When hives are in close proximity to those about to be treated it is safer to close their entrances. This will prevent the bees from the diseased hive gaining admission, and also stop robbing. Prepare a set of frames with a $\frac{1}{2}$ in. strip of foundation wax (called a starter) in each. Next place these frames into an empty body ready to receive the bees. Shift the diseased hive to one side, and place the prepared hive containing the starters on the old stand previously occupied by the diseased colony. The combs with adhering bees are then removed one by one, every bee being brushed off into the prepared hive. The diseased combs are put into a spare hive-body, and covered up as quickly as possible; then remove every portion of the infected hive, including the diseased combs, out of reach of the bees. In four days' time the frames containing the starters are removed from the prepared hive and full sheets of foundation put in their place. The bees must be brushed off quickly and quietly without using much smoke, so that they get very little of the infected honey that has been stored in the combs built from the starters. The fore-going treatment, if carried out carefully and according to instructions, will effect a complete cure. This is accomplished by the bees utilizing the diseased honey in their honey-sacs for the purpose of comb-building; thus when shifted again at the end of four days they start clean. The colonies should then remain healthy unless further infection be gathered from an outside source.

SAVING HEALTHY BROOD.

When there is a large amount of healthy brood which is only slightly infected the hospital treatment may be followed with advantage. Place a queen-excluder over a strong, slightly infected colony, above which supers containing infected brood are placed. The excluder prevents the queen from making use of the affected combs while the brood is emerging. In fourteen days most of the brood will have hatched out, after which the supers can be removed and the combs stored in a place of safety until ready to melt up or destroy. Now proceed to treat the colony as previously explained. In cold weather

do not tier up too high, as there will not be sufficient bees to take care of the brood, and some of it may be chilled. If the disease reappears it should be treated again.

It must be remembered that hospital colonies are extremely dangerous, and are likely to be a continual source of reinfection. They should be placed at some distance from the main apiary, and the greatest care exercised while they are in use. The hive-bodies must be bee-tight except for the entrance, and they should be treated before the main honey-flow ceases.

INFECTED MATERIAL.

The combs, if not too badly infected, may be melted into wax, or, if insufficient in quantity for that purpose, they and their frames had better be burned and the ashes buried. Where the beekeeper decides to convert his combs into wax, the utmost care should be taken to destroy by fire all refuse. The ashes and water should be put into a deep hole and buried.

The hives and appliances may be treated by boiling in a strong solution of caustic soda and water, or, if preferred, the inside of the hives may be scorched with a painter's blow-lamp.

As already mentioned, the beekeeper himself is often the cause of spreading disease by carelessly manipulating foul-broody colonies and then healthy ones. Prevention is better than cure. It is therefore recommended that he should disinfect his hands and appliances with any of the well-known germicides.

NOTES AND CAUTIONS.

On no account should honey be fed to bees; sugar syrup is cheaper and better. Honey from diseased hives may be used for table purposes.

Take the precaution to dig round about the hive so as to bury any honey which may have been spilt.

No treatment will be successful when the bees are allowed to get at any of the combs or honey from an infected hive.

"Eternal vigilance" should be the watchword of every beekeeper who hopes to control diseases.

Combs should not be exchanged from one hive to another until the apiary is free from disease.

Occasionally colonies swarm out after treatment, but this is not likely to occur when honey is being gathered freely. It can be guarded against by placing queen-excluding zinc across a wide entrance until there is brood in the combs.

All swarms from an infected apiary should be treated as if they were diseased.

Keep robbing in check as much as possible.

Should the weather be unfavourable for honey-gathering, it is advisable after treatment to feed a little sugar syrup.

Do not wait until the winter to melt up the wax and clean the combs. Do it at once.

Diseased combs should be immediately removed, so as to avoid reinfection.

TESTING OF PUREBRED DAIRY COWS.

JANUARY CERTIFICATE-OF-RECORD LIST.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

WITH the exception of a few uncompleted returns, this month's list—which gives particulars of certificates issued in January—finishes the publication of records for C.O.R. cows qualifying during the calendar year 1924.

Many good performances appear. Among them is the senior four-year-old Friesian, Hinemoa Beauty, owned by Mr. T. R. Eades, of Edendale. She was on test last year, when she qualified for a certificate on a yield of 812·44 lb. fat. This year her record stands at 822·37. That is to say, in two consecutive seasons she has averaged, on C.O.R. test, 817·40 lb. of butterfat.

At the head of this month's list for mature Friesians is Lady Zozo Alcartra van Racelands, with 832·59 lb. butterfat. She was tested by Messrs. C. W. Baldwin and Son, Ngatoro, Inglewood, and at the conclusion of her testing-period was purchased by John Court (Limited) for the J. C. L. Hobson Farm, at Panmure, near Auckland.

The outstanding Jerseys of the current list are both owned by Mr. A. E. Watkin, Takanini. Lady's Perfection, a four-year-old, has been issued a certificate on 770·20 lb. butterfat; and Mystery's Golden Girl, a mature cow, produced 753·73 lb. butterfat.

The chief feature of the present list, however, is the appearance of two new class-leaders, both in the Milking Shorthorn breed. Dominion Esau of Ruakura adds yet another name to his steadily increasing list of distinguished daughters. In last month's *Journal* reference was made to Matangi Violet 2nd as a new leader of the Milking Shorthorn senior four-year-olds (621·54 lb.). Matangi Ruth 2nd (half-sister) has since completed her C.O.R. test with a yield of 644·90 lb., and thus moves to the head of her class. She also heads the senior three-year-old class on her last season's production of 747·86 lb. Both cows were tested by Messrs. Ranstead Bros.

The other change in class-leadership for the Milking Shorthorn breed occurs in the mature class. The good record which Maniaroa Princess made during the 1919–20 season has at last been broken by Mr. A. J. Melville's Glenthorpe Lady, who goes to the head of the class. Her fine yield of 856·85 lb. butterfat surpasses that of the previous leader by no less than 156 lb. butterfat. Glenthorpe Lady is one of the older generation, and neither her exact age nor her pedigree appears in the Herd-book. This latest record is the third performance in which she has qualified for a certificate of record. Her first season on C.O.R. test was in 1920–21, when in the mature class she yielded 550·05 lb. She was then rested a season, and in 1922–23 was credited with 671·63 lb. When to these are added her last season's figures—856·85 lb. butterfat—it must be admitted that Glenthorpe Lady has proved her capabilities as a producer.

In the same class of the current list appears Mr. Melville's Glenthorpe Daisy, with 694·10 lb. This cow also has two previous records—one of 519·46 lb. and another of 674·46 lb.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Eileen Sylvia ..	F. V. Bryant, Ruawhata ..	1 360	240·5	365	11,371·5	565·34
Ivondale Gold Star ..	P. J. Petersen, Brixton ..	1 322	240·5	365	9,622·3	506·97
Hillview Chrystable ..	F. J. Saxby, Hamilton ..	2 65	247·0	365	9,562·1	483·70
Miss Petune Clematis	R. C. Leach, Woodville ..	2 0	240·5	365	8,615·3	474·08
Tirohia Briar Leaf ..	B. E. Veale, Tirohia ..	2 15	242·0	365	8,254·0	469·18
Wairua Flame ..	A. L. Dermer, Stanway ..	1 333	240·5	365	9,632·8	468·42
Koro Koro Dulcie ..	R. W. Southee, Kiwitea ..	2 18	242·3	365	7,692·3	467·27
Hua Brook Dulcet ..	H. Salway, Bell Block ..	1 353	240·5	365	8,049·3	445·47
Meadowvale Armistice	E. O'Sullivan and Sons, Tariki	1 338	240·5	365	7,122·3	440·84
Balla Mona Nora† ..	W. D. Dron, Spring Grove ..	2 80	248·5	365	7,891·9	439·67
Brookvale Superior Lady	J. Kelso, Pukeroro ..	2 27	243·2	342	7,138·5	437·79
Mecca†	C. Stevens, Maungatapere ..	2 33	243·8	347	7,953·6	432·43
My Lady of the Cave	M. Devenish Meares, Te Puna	2 26	243·1	365	8,440·5	428·57
Koro Koro Dairymaid	R. W. Southee, Kiwitea ..	1 312	240·5	365	6,710·9	417·82
Ngahiwi Lady Patience	W. J. Freeth, Waitara ..	2 45	245·0	361	7,342·8	416·30
Melody's Harmony ..	J. Kelso, Pukeroro ..	2 1	240·6	345	6,218·3	415·57
Koro Koro Joy ..	R. W. Southee, Kiwitea ..	2 4	240·9	365	7,753·3	408·19
Koro Koro Gipsy ..	R. W. Southee, Kiwitea ..	2 56	246·1	365	7,026·2	396·13
Koro Koro Ruth ..	R. W. Southee, Kiwitea ..	2 5	241·0	365	6,370·1	394·07
Jerseydale Trinket ..	J. Pettigrew, Pihama ..	1 307	240·5	362	7,837·9	392·88
Oaklands Rosebud ..	W. H. Jakins, Christchurch	2 18	242·3	365	7,106·9	390·80
Woodstock Suzanne ..	A. Banks and Son, Kiwitea	1 217	240·5	365	7,345·6	389·25
Corra Lynn Madam Swan	A. Best, Bombay ..	2 16	242·1	365	6,538·9	376·41
Twylish Eyes ..	C. Parker, Hairini ..	1 348	240·5	365	5,987·2	367·81
Springburn Gem ..	R. L. Horn, jun., Ohau ..	2 32	243·7	365	6,787·2	361·61
Woodstock Golden Lass	A. Banks and Son, Kiwitea	1 328	240·5	365	6,984·2	358·94
Middlewood Beatrice	Kilgour and Gibson, Kiwitea	2 19	242·4	365	6,344·5	356·15
Holly Oak Pearl ..	A. Hornig, Manakau ..	1 315	240·5	365	7,731·2	355·58
Silverdale Queen ..	G. Hodgson, Whakapara ..	2 81	248·6	349	6,017·7	338·59
Sabean of Bull's ..	F. J. Watson, Bull's ..	2 3	240·8	365	5,260·8	337·68
Molina's Chrystable ..	E. Hofmann, Katikati ..	2 62	246·7	352	5,856·3	320·28
Waimoeiti Sunset ..	A. Jellyman, Richmond ..	2 29	243·4	365	6,099·8	318·49
Hawkesbury Columbine	W. I. Fallows, Puni ..	1 350	240·5	365	6,400·7	317·11
Linwood Breeze ..	W. V. Hosking, Waiuku ..	1 349	240·5	300	5,965·7	300·87
Tinsel's Lady Claribelle	E. Hofmann, Katikati ..	2 38	244·3	296	6,183·3	290·23
Springdale Fidel ..	J. A. Blake, Waipawa ..	2 22	242·7	274	4,996·1	277·86
Springdale Sea Nymph	J. A. Blake, Waipawa ..	2 31	243·6	290	4,837·1	245·58
Senior Two-year-old.						
Majesty Mahone† ..	C. Stevens, Maungatapere ..	2 127	253·2	365	10,336·9	591·38
Remarkable Mary ..	S. Dale, Fairlie	2 152	255·7	365	9,329·3	577·18
Silverdale Joan ..	G. Hodgson, Whakapara ..	2 362	276·7	355	8,534·5	504·34
Woodstock Nonette ..	*A. Banks and Son, Kiwitea ..	2 337	274·2	365	9,643·7	465·21
Belvedere Twylight ..	E. B. Eagle, Greytown ..	2 356	276·1	303	9,046·3	455·22
Ngahiwi Destiny ..	W. J. Freeth, Waitara ..	2 308	271·3	355	7,265·5	431·44
Hua Brook Golden Gift	H. Salway, Bell Block ..	2 189	259·4	358	6,654·4	428·43
Burnside Gem ..	S. J. Hollard, Rowan ..	2 363	276·8	314	5,890·5	363·59
Madrid†	C. Stevens, Maungatapere ..	2 314	271·9	341	6,509·4	331·97
Three-year-old.						
Fancy Princess ..	H. Salway, Bell Block ..	3 332	310·2	365	8,836·4	548·59
Daphne's Glory ..	F. V. Bryant, Ruawhata ..	3 4	277·4	365	8,777·3	525·69

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
			JERSEYS—*continued.*			
Three-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Kairona's Miss Petune	R. C. Leach, Woodville	3 311	308·1	365	8,669·0	523·62
Woodstock Fantail	A. Banks and Son, Kiwitea	3 22	279·2	365	8,378·2	481·18
Maiden's Neatness	W. McKenzie, Palmerston N.	3 102	287·2	365	7,587·8	479·95
Hautere Rosette	C. Parker, Hairini	3 341	311·1	354	8,176·6	446·40
Noble Golden Fern†	C. Stevens, Maungatapere	3 57	282·7	348	8,958·9	411·32
Four-year-old.						
Lady's Perfection	A. E. Watkin, Takanini	4 118	325·3	365	16,449·1	770·20
Rosa's Ripple	S. R. Lancaster, Palmerston North	4 34	316·9	365	10,503·5	622·79
Media	C. Stevens, Maungatapere	4 20	315·5	351	10,095·5	568·92
Silverdale Stella	G. Hodgson, Whakapara	4 9	314·4	365	9,310·1	542·39
La Belle Vache	A. A. White, Auckland	4 103	323·8	363	9,801·5	483·82
Maxim's Maid Brownie†	C. Stevens, Maungatapere	4 312	344·7	365	7,594·4	482·77
Collingwood's Angel	Estate of E. Hellyer, Dunedin	4 232	336·7	295	7,652·3	464·33
Gay's All Brown	B. E. Veale, Tirohia	4 338	347·3	365	7,946·2	440·77
Helen of Rodney	C. Parker, Hairini	4 349	348·4	359	6,803·3	414·58
Royal Patritia†	C. Stevens, Maungatapere	4 117	325·2	342	4,850·3	357·44
Mature.						
Mystery's Golden Girl	A. E. Watkin, Takanini	5 77	350·0	365	13·027·4	753·73
Lady Ivy	John Hale, New Plymouth	8 46	350·0	365	11,444·7	736·66
Dulcie's Belle	W. S. Knuckey, Waitara	5 290	350·0	365	12,650·2	720·94
Kuku's Lightfoot	R. L. Horn, sen., Ohau	8 11	350·0	365	12,415·4	659·72
Norfolk Park's Sea Queen	H. Salway, Bell Block	5 18	350·0	365	10,479·5	628·92
Ponga's Girl	R. C. Leach, Woodville	8 330	350·0	365	10,809·6	622·85
Basra†	C. Stevens, Maungatapere	6 220	350·0	361	11,174·1	596·10
Maxim's Maid Cherry†	C. Stevens, Maungatapere	7 54	350·0	347	9,740·4	592·46
Treasure Trove	W. J. Freeth, Waitara	5 356	350·0	362	11,336·5	571·26
Oakvale's Fussey	I. McEldowney, New Plymouth	5 5	350·0	365	10,297·6	568·57
Viola's Daisy Girl	W. H. Fitness, Rehia	5 24	350·0	365	9,259·9	551·18
Molly Mahone†	C. Stevens, Maungatapere	10 93	350·0	328	9,586·9	532·91
Golden Fernleaf†	C. Stevens, Maungatapere	9 15	350·0	321	9,452·9	522·13
Eileen's Treasure	H. Salway, Bell Block	5 12	350·0	332	9,257·6	515·96
Imogene†	C. Stevens, Maungatapere	6 190	350·0	365	7,994·4	510·27
Beechland's Joy	A. Moreland and Son, Te Rapa	7 205	350·0	365	11,260·1	508·90
Lucky Find	W. S. Knuckey, Waitara	6 50	350·0	314	8,489·9	505·91
Golden Wonder†	C. Stevens, Maungatapere	7 103	350·0	323	10,444·4	498·91
Maxim's Maid Ruby†	C. Stevens, Maungatapere	7 27	350·0	365	10,782·5	478·50
Nirvana	A. Moreland and Son, Te Rapa	11 142	350·0	365	9,477·0	475·36
Fascination	R. C. Leach, Woodville	10 286	350·0	347	9,073·8	468·03
Lady Joffre	E. L. Roose, Pukekohe	9 12	350·0	365	9,773·7	466·75
Cecile†	C. Stevens, Maungatapere	7 41	350·0	357	7,740·8	447·44
Cosmos†	C. Stevens, Maungatapere	6 298	350·0	320	8,945·9	447·02
Genee†	C. Stevens, Maungatapere	7 34	350·0	359	6,995·9	443·18
Charming Irene†	C. Stevens, Maungatapere	8 349	350·0	307	8,563·8	431·16
Silverdale Lilac	G. Hodgson, Whakapara	5 118	350·0	308	8,231·8	414·42
Murie†	C. Stevens, Maungatapere	7 57	350·0	365	8,475·4	403·87
Mistral†	C. Stevens, Maungatapere	8 345	350·0	365	8,535·3	403·13
Damsel Fox	C. Parker, Hairini	6 6	350·0	336	7,454·6	399·03
Golden Vision	A. A. White, Auckland	9 35	350·0	287	7,512·0	381·06
Rewa Maytime	J. A. Blake, Waipawa	8 203	350·0	332	7,233·2	379·03

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Matangi Manola* ..	Matangi Friesian Farm Co., Matangi	1 348	240·5	365	13,904·5	448·27
Fencourt Arcadia† ..	J. H. Jamieson, Cambridge	2 25	243·0	365	12,142·6	400·71
Miss Rose de Kol† ..	R. H. Hammond, Ohakune	2 108	251·3	350	12,657·8	396·81
Longbeach Daisy 4th*	J. H. Grigg, Longbeach ..	2 82	248·7	365	11,845·6	396·06
Marire Zuyder Girl ..	F. O. Stack, Kiwitea ..	1 274	240·5	365	9,151·2	392·07
Segis Colantha Abbekerk†	H. W. Hoskin, Mangatoki	1 359	240·5	355	11,254·0	368·34
Jessica Posch of Oakview	H. T. Cook, Appleby ..	1 311	240·5	333	9,680·5	366·52
Colantha Segis Pauline†	H. W. Hoskin, Mangatoki..	2 31	243·6	331	11,016·2	356·64
Colantha Abbekerk de Kol†	H. W. Hoskin, Mangatoki..	2 42	244·7	336	10,671·7	351·98
Mahoe Ixia Pontiac*	R. A. Wilson, Turakina ..	1 333	240·5	365	8,456·3	299·71
Senior Two-year-old.						
Queen Mercena Posch†	N. P. Nielsen and Son, Tiakitahuna	2 248	265·3	365	13,302·7	471·69
Oaklea Mercena Lassie*	R. A. Wilson, Turakina ..	2 338	274·3	365	9,239·8	439·73
Longbeach Netherland Princess*	J. H. Grigg, Longbeach ..	2 284	268·9	365	12,370·6	410·93
Marire	F. O. Stack, Kiwitea ..	2 298	270·3	337	8,931·4	395·24
Marire Twylight ..	F. O. Stack, Kiwitea ..	2 339	274·4	365	10,633·3	384·55
May Mischief Alcartra†	S. Andrew, Kaikoura ..	2 363	276·7	327	10,157·1	370·18
Roslyn Netherland Pride*	R. A. Wilson, Turakina ..	2 281	268·6	274	11,084·9	361·46
Dominion Mercedes Pride	Central Development Farm, Weraroa	2 264	266·9	349	11,163·7	329·93
Junior Three-year-old.						
Oaklea Julip Pietertje†	N. P. Nielsen, Tiakitahuna	3 36	280·6	300	15,031·9	470·60
Oaklea Creamelle* ..	R. A. Wilson, Turakina ..	3 136	290·6	321	12,936·5	415·54
Ashlynn 66th ..	R. A. Wilson, Turakina ..	3 9	277·9	279	9,499·7	387·78
White Rose Alcartra†	S. Andrew, Kaikoura ..	3 70	284·0	341	11,756·7	363·49
Bloomfield June de Kol†	Bloomfield Farm Co., Wellington	3 153	292·3	300	9,164·8	341·29
Springbrook Belle Westport†	John Court, Ltd., Auckland	3 363	313·3	365	19,583·5	627·00
Junior Four-year-old.						
Tinie Korndyke* ..	John Court, Ltd., Auckland	4 0	313·5	365	22,521·1	679·99
Mary Alcartra† ..	S. Andrew, Kaikoura ..	4 86	322·1	338	13,003·9	474·02
Ashlynn 49* ..	R. A. Wilson, Turakina ..	4 70	320·5	330	10,788·3	384·93
Fencourt Pet† ..	J. H. Jamieson, Cambridge..	4 68	320·3	322	11,851·1	344·81
Senior Four-year-old.						
Hinemoa Beauty* ..	T. R. Eades, Edendale ..	4 347	348·2	365	23,973·0	822·37
Lady Astor Alcartra†	S. Andrew, Kaikoura ..	4 192	332·7	360	13,817·3	386·46
Mature.						
Lady Zozo Alcartra Van Racelands*	C. W. Baldwin and Sons, Ngatoro	5 359	350·0	365	23,158·6	832·59
Pietje Manola* ..	Matangi Friesian Farm Co., Matangi	7 349	350·0	365	18,964·0	657·16
Lady Josina Segis† ..	C. R. Duncan and Sons, Whangamarino	7 241	350·0	365	16,146·3	598·14

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Tirania of Carlowrie†	R. K. Macdonald, Edendale	7 348	350·0	365	18,927·5	587·01
Manola Princess* ..	Matangi Friesian Farm Co., Matangi	6 352	350·0	365	16,422·2	578·73
Parthena Alcartra Rose†	H. W. Hoskin, Mangatoki..	8 43	350·0	365	16,994·0	545·27
Galatea Segis 3rd† ..	H. W. Hoskin, Mangatoki..	7 57	350·0	365	16,222·2	528·84
Woodlyn Lylac de Kol†	T. C. Barbour, East Tamaki	5 62	350·0	327	14,063·3	517·94
Ashlea Mascot Colantha*	R. A. Wilson, Turakina ..	6 343	350·0	364	12 939·8	495·31
Grebegga Pauline of Kulnine†	S. Andrew, Kaikoura ..	7 66	350·0	332	13,883·5	484·25
Segis 2nd Rose† ..	H. W. Hoskin, Mangatoki..	7 53	350·0	365	15,042·5	481·70
Princess View† ..	G. A. Marchant and Sons, Cardiff	9 47	350·0	182	12,506·2	459·75
Longbeach Big Dutch Queen*	Muff Bros., Orari.. ..	6 288	350·0	299	12,674·2	444·16
Kittie Maid of Maplehurst*	R. A. Wilson, Turakina ..	5 66	350·0	275	13,675·9	440·86
Dutchmain 4th† ..	N. P. Nielsen, Tiakitahuna	8 87	350·0	303	12,942·8	409·04
Fairmont Grace Pietertje*	James Hart, Tatuanui ..	5 88	350·0	214	11,199·3	399·47
	MILKING SHORTHORNS.					
Junior Two-year-old.						
Glenthorpe Daisy 2nd†	A. J. Melville, Buckland ..	1 349	240·5	365	10,123·3	432·09
Pine Farm Jewel 4th A	J. Parkinson, Opotiki ..	1 268	240·5	365	10,189·9	406·76
Matangi Riri† ..	Ranstead Bros., Matangi ..	2 8	241·3	365	9,380·5	345·99
Brookside Beckey ..	J. Pease, Matatoki ..	2 76	248·1	326	7,445·5	305·79
Berkenlee Eclipse ..	J. W. Robinson, Runciman	2 2	240·7	338	6,688·1	275·79
Willowbank Lady ..	J. W. Robinson, Runciman	2 152	255·7	302	6,404·7	260·19
Senior Three-year-old.						
Matangi Sunshine 2nd†	Ranstead Bros., Matangi ..	3 361	313·1	365	12,386·5	524·44
Senior Four-year-old.						
Matangi Ruth 2nd† ..	Ranstead Bros., Matangi ..	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady* ..	A. J. Melville, Buckland ..	..	350·0	365	20,136·2	856·85
Glenthorpe Daisy* ..	A. J. Melville, Buckland ..	..	350·0	324	14,025·2	604·10
Riverdale Dolly 1st†	T. W. Wardlaw, Waimana..	..	350·0	365	16,902·7	623·48
	AYRSHIRES.					
Four-year-old.						
Betty 4th of Waipapa	Fred. Mills, Waipapa ..	4 337	347·2	335	9,815·2	383·72
Mature.						
Ivanhoe Fancy* ..	A. M. Weir, Menzies Ferry..	6 25	350·0	352	11,432·8	547·88
Meg of Haydowns ..	Fred. Mills, Waipapa ..	..	350·0	353	12,137·0	472·57

Second-class Certificates.

JERSEYS.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
Junior Two-year-old.						
Collingwood Iris ..	G. Murray, Lake Tekapo ..	2 27	243·2	365	5,276·3	340·17

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	Second-class Certificates—continued.					
	JERSEYS—*continued.*					
Senior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Palmdale Golden Dawn	D. Kennedy, Morven ..	2 359	276·4	365	9,775·0	559·05
Holly Oak's Lady General	John Hale, New Plymouth	2 191	259·6	365	9,101·7	531·74
Three-year-old.						
Folly's Pet ..	G. A. Gamman, Marton ..	3 273	304·3	365	9,419·7	532·20
Tower View Princess	O. Ross, Waihi	3 344	311·4	365	5,949·7	372·66
Rainsbrook Veronica	W. C Raymond, Pleasant Point	3 351	312·1	318	5,711·7	325·00
Four-year-old.						
Nellie	James Naughton, Matapu ..	4 376	341·1	365	10,470·9	564·91
Mature.						
Lady Superior ..	John Hale, New Plymouth..	6 168	350·0	365	15,985·2	997·30
Rewa Ambrosia ..	W. H. Hall, Carterton ..	7 246	350·0	365	12,001·3	482·04
Oakden Rosebud ..	W. H. Jakins, Christchurch	7 316	350·0	283	8,373·3	423·43
	FRIESIANS.					
Senior Four-year-old.						
Rosevale Burkeyje Flora*	H. North and Sons, Omimi	4 287	342·2	365	21,270·4	793·15
Mature.						
Millbrook Pietje Netherland*	Matangi Friesian Farm Co., Matangi	11 322	350·0	365	19,309·8	725·91
Friesland Park Alba Colantha*	Muff Bros., Orari.. ..	9 233	350·0	365	16,191·5	541·46
Pauline de Kol Fayne*	R. A. Wilson, Turakina ..	5 9	350·0	365	13,096·2	447·77

CATTLE-TICK INVESTIGATION BULLETIN.

A BULLETIN entitled "The Cattle-tick (*Haemaphysalis bispinosa*): Investigations during 1923–24" (No. 116) has been issued by the Department. The author is Mr. J. G. Myers, of the Biological Laboratory Staff, Wellington (at present in America), who contributed to the *Journal* of May, 1924, a summary of this his main report on the subject. The bulletin is of 105 pages, royal octavo size, with seventeen illustrations, and a limited edition only has been printed. For this reason it can be supplied only to special applicants.

Rabbit-control in Manawatu.—Regulations under the Rabbit Nuisance Amendment Act, 1920, were gazetted on 23rd January, the effect of which is to suspend trapping in the Manawatu Rabbit District except by permission and under conditions specified by the Board.

Wet-weather Work.—When rain prevents outside work at this season, time may profitably be devoted to the cleaning and oiling of the haymaking and harvesting machinery.

CARBON BISULPHIDE FOR RABBIT-FUMIGATION.

Live-stock Division.

WHERE rabbits are living in burrows on fairly open country, fumigation of the burrows with carbon bisulphide is easily the most effective method of destroying them. Following are directions for the use of this material, and other relevant hints :—

Procure a deep tin or billy, about 6 in. in diameter — one fitted with a lid for preference. Cut pieces of old sacking of a size to fit into the tin selected, and, after filling the tin with these, pour in sufficient carbon bisulphide to cover them well. If any considerable time is likely to elapse after the carbon bisulphide is poured into the tin containing the pieces of sacking, the tin should either be covered with a tight lid, or sufficient water added to cover the carbon bisulphide ; the water will float on the latter and prevent evaporation.

Be careful to locate every exit from the burrow to be fumigated, and, when this is done, dig each back sufficiently to provide a solid face. Push a piece of the sacking saturated with carbon bisulphide *well into each burrow* with a rod or piece of wire, then fill the openings with plenty of earth, and *tread or ram tightly*. If it is desired to ignite the gas, proceed as just stated, excepting that one opening should be only lightly covered so that it may be easily reopened. *Allow about four minutes* for the gas to permeate the burrows after the saturated sacking has been added and the openings closed, then reopen the one which has been lightly covered, and, after placing a fresh piece of saturated sacking, ignite the gas with a torch or match. (Caution : The operator should stand well to one side when igniting the gas.) If any of the openings should be uncovered by the explosion they should be reclosed as directed above. It is a decided advantage to ignite the gas when dealing with very large burrows, as a much greater volume is thereby produced, and the explosion which results forces the gases to the farthest recesses of the burrows ; it will also show any openings that may have been missed.

In order to get the maximum results, all the country in the vicinity of the burrows which it is intended to fumigate should be thoroughly hunted with dogs to drive rabbits that may be lying out into the burrows before fumigating.

Excepting in land of very open texture, such as sandy formation, fumigation can be effectively carried out at any time ; but the best results are obtained during fairly calm weather and when the earth is moist. The most favourable time is during showery weather or after rain. Burrows in land of open texture, such as pumiceous or sandy formation, should be fumigated during showery weather or immediately after a fall of rain.

Carbon bisulphide evaporates very quickly when exposed to the atmosphere. In order to guard against this, after opening a container of the material, pour enough water on top to completely cover it. If a cork is used it should be sealed with glue, mucilage, or glycerine. If water is added to prevent evaporation, care must be taken to ensure that it is *all poured off* immediately before the carbon bisulphide is again used, as otherwise the sacking may be saturated with water in place of carbon bisulphide.

Carbon bisulphide should be carefully kept away from fire.

SEASONAL NOTES.

THE FARM.

AUTUMN SOWING OF PASTURES.

MARCH is one of the best months for sowing pastures, both temporary and permanent, on the lower-lying country. With altitudes over 1,000 ft. better results are generally obtained by late spring sowing. The main point is to sow at a time when clovers will get well established before severe frost sets in. There is a great diversity of opinion, especially in regard to permanent pasture, as to whether some cereal should be sown with the grass-seed to afford shelter. In the majority of cases the grass is best sown by itself, as the cereal is a keen competitor and generally causes the grass stand to be weaker than if sown alone. There are, however, certain exceptions. Thus, in very exposed situations a bushel of oats or barley per acre may be used for shelter advantageously, and again if the sowing is late (say, at the end of April or in May); but in no case should more than 1 bushel be sown with a permanent-grass mixture.

In deciding on a grass-mixture great care is necessary to ensure that grasses suitable to the land and locality are selected, and that a proper balance between grasses and clovers is maintained. For first-class free lands the following permanent mixture is a good basis to work on: Cocksfoot, 12 lb.; perennial rye-grass, 16 lb.; Italian rye-grass, 4 lb.; timothy, 4 lb.; crested dogstail, 2 lb.; red clover, 3 lb.; white clover, 2 lb.: total, 43 lb. per acre. Where the land is stiffer and wetter the following is suggested: Cocksfoot, 6 lb.; perennial rye-grass, 20 lb.; timothy, 4 lb.; meadow-fescue, 4 lb.; meadow-foxtail, 2 lb.; alsike, 2 lb.; red clover, 2 lb.; white clover, 2 lb.: total, 42 lb. per acre. Under North Island conditions, if the land lies warm, 10 lb. of prairie-grass may be added with advantage to the former mixture.

Temporary pastures consist of (1) a truly temporary pasture to last one year only, and (2) a temporary dairying pasture that with care may be carried on from two to four years. For the former a sowing of 25 lb. Italian or Western Wolths rye-grass and 5 lb. red clover per acre is suitable; and for the latter 16 lb. perennial rye-grass, 12 lb. Italian rye-grass, 4 lb. red clover, and 2 lb. white clover is recommended; while for land of a free and warm nature in the North Island 10 lb. of prairie-grass could again be added. If the last-mentioned mixture is judiciously top-dressed it should remain good for three or four years

In preparing the land for pasture, care must be taken to provide a fine, firm tilth. If the soil is not well consolidated a great deal of the seed is buried too deeply and fails to germinate. The ideal condition is to get the seed buried about ½ in. deep. If the seed-bed has been well consolidated, light tine harrows give good results, otherwise chain or brush harrows are the best. The question of rolling after sowing at this time of the year must be left to the farmer's judgment. No hard-and-fast rule can be laid down. If the land is dry and the weather inclined to be fine, rolling should be done. If, on the other hand, the land is at all wet and rain frequent it is better not to roll.

Suitable manures for applying with pastures are basic super or basic slag, 2 cwt. per acre, or mixtures of 2 cwt. super and 2 cwt. carbonate of lime. If it is considered that the land is weak in plant-food and heavier dressings are desirable the extra dressing is better applied in the early spring.

WINTER AND EARLY SPRING FORAGE CROPS.

The sowing of these crops should now be pushed along. If the crop is to be grazed during winter and early spring, and the land then turned over, Algerian oats at the rate of 3 to 4 bushels per acre are probably the best for general purposes, or a mixture of 2 bushels Algerian oats and 1 bushel Western Wolths rye-grass. Black Skinless barley at 2½ bushels per acre also gives good results, and if feed is desired quickly it is the best, as it is usually ready to feed two or three weeks before any other cereal. When the land is inclined to be sour a mixture of Algerian oats and rye-corn, half and half, 3 to 4 bushels per acre, is recommended. If the crop is to be fed during winter and carried on for hay or ensilage, a mixture of 2½ bushels Algerian oats and 1 bushel grey tares is advised, as this mixture makes better ensilage than oats alone. Sometimes tares are sown with oats where it is intended to prepare the land for another crop in the spring. In such case it is doubtful if sufficient fodder is obtained from the tares to warrant their inclusion. Unless the land is very rich this type of crop should be liberally manured; super or basic super, at 2 cwt. per acre, is a suitable fertilizer.

HARVESTING CLOVER-SEED.

A feature this season in some districts, such as Marlborough, was the late appearance of the humble-bees. For farmers whose growth of clover, after the November or December hay-cut, was late coming into head this would, if anything, be an advantage, while in the case of stands which have headed early many of the heads will mature without setting seed and so become dummies. Where the majority of the clover-heads fall into this category it goes without saying that the farmer will be well advised to make a hay-cut instead of allowing the crop to remain for seed. When the clover-seed may be rubbed out from the majority of the heads, and when the stalks begin to lie over at an angle of 45°, it is time to cut. The best method of harvesting is probably to use steel bands which trail behind the mower. These are especially valuable when white clover is being cut. When this method is employed the driver of the mower uses an improvised seat—half a sack of chaff being a handy method. The mower-seat should be turned back to front. A second man sits on this and guides the clover out into heaps which lie clear of the wheel in the course of the next cut. By this system the clover may be left in windrows without any trouble. The bands work best with very dry material. Another method of clover-seed harvesting commonly employed and generally attended with successful results is that involving the use of the side deliverer.

If the material is exceedingly dry it may often be threshed immediately after stacking, before the stack begins to sweat. However, it is frequently the case when the clover is stacked that many

of the heads are somewhat immature, hence a certain amount of curing in the stack is essential. Once the stack goes into the sweat it should be left for at least a month before threshing is attempted. After threshing is completed the straw-stack should be built with a steep pitch to turn the rain.

LUCERNE.

Young spring-sown crops should be ready for a second cutting during March, and as the weather is then usually dry it is a good time to give them a light cultivation. The tine harrows are, as a rule, heavy enough for this operation. The object is to destroy any grass or permanent weeds that are getting established, and leave the surface of the land in free condition for the winter. Young stands of lucerne should not be grazed in the first season.

Old stands that are getting thin can have their usefulness considerably extended by sowing Italian rye-grass on them after the autumn cultivation. The rye-grass fills up bare ground and provides a heavy crop in the spring. In some districts the practice of sowing 2 bushels of Algerian oats on lucerne stands in March and April has become fairly common, the object being to fill up all bare ground, crowd out weeds during the winter months, and provide a heavy spring crop for green feed or ensilage. So far observations indicate that where the oat crop is cut fairly early no harm is done, but where the oats are allowed to get well out in ear there are indications that the subsequent growth of lucerne is slightly stunted. However, there is not yet sufficient evidence to warrant definite conclusions regarding the relative benefit or otherwise of this practice to the lucerne stand.

PASTURE-MANAGEMENT AND SURPLUS FEED.

Owing to the favourable season there is now on many farms a surplus of feed that can be usefully disposed of. Pastures that have "got away" should, if possible, be mown, more especially in northern districts where the dominant grass is paspalum. This allows the young undergrowth to make a start, and freshens up the feed. If the paddocks are taken in rotation at intervals there will be no shortage, even for a few days, and the benefit derived from the clearing-away of the rank unpalatable top growth is soon noticeable On some farms this surplus grass can be raked together and made into hay or ensilage, so that a double benefit is obtained. In any case the mown grass, if there is any quantity and it is not eaten on the ground by stock, should be removed from the surface of the paddock, and the tripod harrows set to work. This harrowing spreads the stock-droppings and breaks the hard surface of the ground, thus permitting the entrance of any rain that falls.

Surplus crops of maize and Japanese millet should be converted into ensilage. The stack method is quite suitable for this purpose, more especially if there is over, say, 25 tons of material. With less material than this the proportion of waste is apt to be high, but even this is better than allowing crops to become frosted and a total loss.

—*Fields Division.*

THE ORCHARD.

MARKETING OPERATIONS.

DURING the next two months the harvesting of all mid-season varieties of apples and pears will engage the attention of growers. This usually means a very busy time in picking, grading, and packing. It is to be hoped that every endeavour will be made by those exporting to do all in their power to comply with the regulations, and pack only such fruit as will bring credit upon the fruit in overseas markets.

With reference to fruit intended for the local markets, growers will be well advised when packing not to include anything that is visibly codlin-mothed, and to guard against any stray infested fruits getting in. Every endeavour should be made to eliminate this pest altogether; if instructions have been carried out codlin-moth should be conspicuous by its absence. Blemishes caused by branch rubs or slight infection of black-spot, when weather conditions have been such as to make spraying at the correct time a difficult matter, sometimes escape the vigilance of packers, but the inclusion of such fruits should be avoided as much as possible.

Fruit intended for cool-storage purposes should be allowed to reach that stage of maturity when it will keep best. That period can best be judged from past experience. It is quite obvious that the fruit should not be fully ripe but yet fully mature. This period varies with different varieties in different localities.

SPRAYING.

It will still be necessary to continue spraying late varieties of apples and pears with arsenate of lead for codlin-moth and leaf-roller caterpillar. If red spider is in evidence lime-sulphur should be added, although very little good will result if the measures previously recommended for controlling this pest have not been put into practice. This insect does most of its damage to foliage during December, January, and February, and then deposits its eggs in every sheltered portion of tree — buds and the under-sides of branches — in readiness for the following season.

Woolly aphis should be kept in check by spraying the trees with Black Leaf 40, 1–800; or, where fruit has been gathered, red oil, 1–60, can be used. Spraying for this pest does not consist in merely wetting the trees. It is necessary to use a high-pressure pump in making the application, so as to remove the covering protecting the insects, thus enabling the fluid to make direct contact with their bodies, otherwise spraying is of very little value.

—*L. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

Where necessary a further application of fungicidal spray — bordeaux, 4–4–40—should be applied to all citrus-trees during the coming month. Other work will include the maintenance of thorough cultivation and the harvesting of any remaining fruit.

FIREBLIGHT.

There is yet time this season for further infection from fireblight to occur in the form of tip-infection, and strict watch must be kept

in order to identify the same immediately upon appearance. In case of infection, treatment should be carried out as outlined previously in these notes.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CULLING.

THE coming month is an excellent period for culling the second-year hens. Any of these showing signs of moulting should be disposed of at once, for as a general rule it indicates that their profitable laying-period has passed; moreover, the early moulter is always undesirable for the breeding-pen. The marketing of birds should not be delayed until the moult has practically set in. They should be disposed of immediately they commence to take their rest prior to going into a moult, as from a poulterer's point of view the bird in heavy moult is difficult to dress and does not present an attractive appearance.

In addition to weeding out all two-year-old birds that show signs of having passed their best period of production, the first-season layers should also be gone through and the weak ones discarded. As a general rule the latter will commence to moult before the former. Thus when one-year-old and two-year-old birds are running together, and there is no mark for age-determination, the time of moulting will not give a good guide in the work of culling. In such cases the only safe course is to discard all birds showing a weak constitution. No sentiment should be allowed to enter into this matter, as in practically all flocks birds are found that will not pay beyond their first laying season. Especially is it necessary to keep only high-class laying stock in these times of exceptionally high cost of foodstuffs.

Birds it is intended to cull at the termination of the present laying season, and which are now in a laying condition, should be forced for egg-production by including a good supply of meat, milk, &c., in the ration, so as to secure every possible egg from them before being marketed. Even if an odd bird shows the effects of the forcing condition by ovarian troubles, &c., it will pay to destroy it rather than retard the laying of the others by providing a less forcing ration.

Returning to the question of culling out the early moulter, it is sometimes claimed that the bird which moults first must necessarily be the first to recover from it, and will naturally be in a producing condition when the feathers of the late moulter are being renewed, thereby showing as good a profit for the year as the latter. This may be true in isolated cases, but in a general way it is not so. It stands to reason that for a bird to be a heavy egg-producer she must necessarily be a long-season layer, and obviously to be a long-season layer she must be a late moulter, for it is rarely that fowls moult and continue laying at the same time. It will generally be found that the high-type layer (the late moulter) will lay for several weeks longer in the autumn (when the price of eggs is on the up-grade) than the early moulter, and then, after renewing its feathers, will resume laying before the bird that moulted first. Of course, no rule

is capable of universal application, and, not unlike all other things connected with poultry-keeping, local conditions must always be taken into account.

PROSPECTIVE BREEDING-HENS.

The next breeding season is certainly far off, but nevertheless no time should be lost in selecting the best hens for future breeding operations. If the best specimens are to be secured the selection must be carried out before the general moult sets in. At this time certain signs manifest themselves indicating laying-capacity and constitutional vigour. These signs generally vanish as the moult sets in, and are not easily observed again until towards the termination of the following laying season. The signs include late moulting, tight feathering, bright prominent eyes, clean face (often the head being devoid of feathers), deep abdominal development, with fine texture of skin, well-developed crop, and an active businesslike appearance. These points should be combined with breed characteristics, and, above all, the birds should conform to the standard weights of the breed they represent.

As the birds are selected they should be carefully marked and placed by themselves, preferably on a free range. They should not be forced for egg-production. Such birds should receive a plain ration and be kept in a healthy but not overfat condition, and otherwise given every opportunity to recuperate after their exhaustive laying season. It must be remembered that they have the moult to go through, which is in itself a considerable drain on the body. This must be made good before the laying season, as if the birds are to leave highly desirable progeny they must have the necessary vitality inseparable from good health when called upon to produce eggs for reproductive purposes.

When considering the birds that are to be kept for future breeding purposes it is a good plan to have trap-nests, so that birds which lay small eggs may be discarded and their places taken by better stock. The matter of small eggs is becoming a serious one, especially in view of the fact that they cannot be exported to the same advantage as, say, the 2 oz. product. There is no better way of raising the standard weight of eggs than by eliminating from the breeding-pen birds which lay eggs of an undesirable size.

DEAR EGGS.

During next month the majority of the adult hens will be preparing for or passing through the moulting process. It is therefore a time when the pullets must be depended upon for the main egg-yield. Obviously the pullets should be provided with every favouring condition if a maximum of dear-season eggs is to be produced. Of course, they should now be settled down in their permanent winter quarters, and the management they receive should be as uniform as possible. Changing the birds from house to house just when they have commenced to lay, or are on the point of laying, is apt to bring on a premature moult and a loss of winter eggs. Any sudden change of diet is also apt to have this undesirable effect; any change should be made as gradually as possible.

If the birds are to lay to their maximum capacity some forcing-food, such as boiled meat, meat-meal, &c., should be included in the ration. Beware of poor-quality foodstuffs, especially where the laying pullet is concerned. Some of the samples of ground food upon which my opinion has recently been asked would be dear at half or even a quarter of the price charged for them—especially some of the so-called oaten pollards. These chiefly consisted of ground husks, which are of no food value and next to useless for promoting egg-production. The cost of good-quality foodstuffs is certainly high at the present time, but nevertheless it is a penny-wise-and-pound-foolish policy to purchase damaged or inferior lines because they are cheap. A much better way to economize is to cull out the poor layers and give the remaining stock the best-quality food that is obtainable. Poultry-keepers who have a supply of last season's wheat should reserve this as far as possible for the pullets, as a sudden change from old to new wheat will probably bring on a premature moult.

Above all things should be remembered the important influence of prevailing weather conditions on the pullet bred to lay in winter. In last month's *Journal* some advice was given regarding the common causes of pullets catching colds, but it is well to emphasize the necessity of their not being subjected to extremes of weather. Again, in order to obtain eggs in the cold dear season the pullet should be given every opportunity to take exercise in comfort when unfavourable climatic conditions prevail. For this purpose the floor of the house should be well covered with litter, in which the birds are compelled to scratch for their grain ration. Among other things they require is plenty of succulent green food, gravel grit, crushed sea-shell, and clean water.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FINAL EXTRACTING.

FEBRUARY will probably see the end of the main honey-flow in most districts, and beekeepers will be wise to remove the last of the honey before the cold nights arrive. Once the honey in the hives has been allowed to become thoroughly chilled there is little prospect of its becoming warmed again when uncertain weather sets in. Wherever inclined to be thick the honey will be found exceedingly difficult to extract unless it is warm, and the beekeeper who delays too long will find that he will have to return to the hives combs almost as heavy as when they were removed. Thin honey extracts best when it is warm, but it is imperative that thick honey be not allowed to cool before extracting.

One of the principal matters to be attended to when the last of the honey is being removed is the condition of the brood-chamber. Many prolific queens keep the brood-chamber so full of brood throughout the season that the bees have very little room to store honey in it. Consequently, if all the honey in the supers is removed, such colonies stand a chance of being starved out before the end of the

winter. These colonies should not be reduced to less than two stories, and on no account should their stores be less than 30 lb. to 40 lb. It must be borne in mind that all the brood in the hive will hatch and must be fed, and that in addition the queen will continue laying for some months to come, while in some districts breeding may continue throughout the winter. To ensure the colony coming out strong in the spring it must be left with ample stores to carry it through the months of dearth. Unless there is ample evidence of an abundant autumn flow the beekeeper would be wise to leave his hives oversupplied rather than undersupplied.

USE OF BEE-ESCAPES.

For the comb-honey producer the Porter bee-escape is an invaluable aid in the removal of his crop. Removal of comb-honey by the ordinary method of brushing, &c., is apt to result in the piercing of many cell-cappings, with consequent leakage; but by the use of this simple little appliance, fitted in a board the size of a super, comb-honey can be removed without any disturbance of the colony. The super or supers should be prised up from the brood-chamber, two or three puffs of smoke driven into the hive, and the board gently slipped into place with the round hole of the escape uppermost. If this is done in the afternoon, by morning the super will be empty of bees.

For extracted honey the use of the escape is a more doubtful matter. In the first place, it is of absolutely no avail where there is brood in the super. The bees will not leave the brood, and the morning will find the combs still covered with bees. It might almost be said that the bee-escape is of no use for extracting combs unless the hives have been previously provided with excluders. In addition, especially in Southern districts, the use of the escape-board tends to allow the honey to cool considerably before morning, thereby making the work of extracting a much more difficult proposition. If there is a tendency to rob, the use of the bee-escape will materially assist in removing the honey late in the season, and whether their use is invariably advocated or not it is as well to have a few on hand.

PREVENTION OF ROBBING.

The taking of the last of the honey is the time when the beekeeper must display endless caution to prevent robbing. A bad attack of autumn robbing is—next to disease—about the worst thing a beekeeper can experience. Before starting the day's work he should have all appliances handy, have formed a plan of how the work is to be carried out, and should, if satisfactory, adhere to that plan throughout the day. A light barrow fitted with a tray to catch honey-drips, and two or three cloths of a size to cover the whole of a super, and moistened with a very weak solution of carbolic acid, are some of the things which will obviate much trouble. As the combs are removed from the supers they should be brushed and shaken as free of bees as possible, placed in an empty super on the barrow, and covered with a damp cloth. Close every hive as soon as it is finished with, and remove the combs to the honey-house, which should be bee-proof. At the close of the day the wet combs should be returned to the hives as expeditiously as possible, and by morning the apiary will

be found to be in its normal condition. No pieces of wax, spilt honey, or anything likely to attract the attention of the bees should be left uncovered.

If the bees show a tendency to pounce on any particular hive the entrance should be contracted considerably and wet grass piled in front of the hive. If working in one portion of the apiary should cause robber bees to become too attentive it is advisable to shift the scene of operations to another part. It must be borne in mind that autumn robbing once commenced is hard to check, also that it is usually brought about by careless manipulation of the hives.

WEAK COLONIES.

As far as possible weak hives should not be tolerated during the winter months. During the warm days these stocks rarely escape the attention of robber bees, and are easily molested. Once they are attacked it is exceedingly hard to save them, and despite the efforts of the beekeeper they eventually get robbed out. It is usually the presence of weak hives in the apiary that starts autumn and winter robbing, and it is by far the best plan to unite them with stronger colonies in the apiary and avoid the risk of creating a disturbance among the bees when normal winter conditions should prevail. If weak colonies are not detected until late in the season a good plan to follow when uniting them is to put the weak hive on top of a strong one, placing a piece of newspaper between the two hive-bodies. In the course of a few days the bees in the weaker hive will eat their way through the paper and unite peaceably with the bees in the stronger hive. The surplus combs may subsequently be removed, and the hive made snug for wintering. If weather conditions permit, it is advantageous to destroy the queen in the weaker hive prior to uniting.

PREPARATIONS FOR WINTER.

As soon as the last of the honey is removed the beekeeper should see that the colonies are in good order for wintering. The first matter for attention is that of stores, which, as already indicated, should be abundant; the second that of the queen's condition. After these two important matters are settled the beekeeper should satisfy himself that his hives are watertight and draught-proof, also that his apiary is well provided with shelter in the form of good hedges or other wind-breaks.

With regard to the queen, autumn is the time when strict attention should be paid to weak and failing queens. None but the best queens should be allowed to go into winter quarters. Poor queens should be destroyed, and either superseded by young and vigorous ones or their colonies united with those of the better queens before the winter sets in. No queen should be tolerated which cannot provide the colony with an abundant supply of young workers before the cold weather arrives. It is quite certain that the queen that goes back in the autumn will be in worse case after the winter, and will not produce enough workers to provide a surplus in the following season, even if she does not fail entirely before the spring or develop into a drone-layer as soon as brood-rearing commences.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

VEGETABLE sowings for the coming month include turnips, spinach, lettuce, early cauliflower, and cabbage, and large white and main-crop onions. Turnips and spinach come into early use, but the remainder form an important contribution to the spring and early summer supplies.

Varieties of lettuce, cauliflower, and cabbage proved suitable to the locality at the season should be selected and sown in seed-beds well prepared and in good heart. The land where they are to be planted out is now probably occupied by peas, beans, or root crops, or in many cases by tomatoes. It should be warm well-drained land, carefully kept free of weeds, as if these are allowed to seed they cause endless work during the moist weather of winter and early spring, when there is little opportunity of destroying them with the hoe. As soon as the present crop is harvested apply a good dressing of manure, and cultivate the land in preparation for the plants, which will then be ready for putting out.

In many districts the main sowing of the all-important onion crop will be made now. Not only the mild large white Italian onions that are so invaluable in spring salads, but in many districts the better-keeping sorts are sown now for planting out in early spring, so that they may be harvested in the dry weather of midsummer and escape the ravages of mildew fungus. It is specially desirable that the land for the seed-bed should be firm and clean of weeds and their seeds. Sow the onion-seed thinly.

When the main celery crop has almost finished its growth it may be cleaned up, removing suckers and dead leaves, and then earthed up for the purpose of blanching the stems. This usually is best done in one or two operations. Choose fine dry weather. Tie the bunches carefully with damp raffia or flax, and make the soil fine and friable before filling it round the plants.

Carefully protect the growth on the asparagus-beds. In exposed windy places it is sometimes worth while putting stakes and a two-ply binder-twine along the leeward side of the bed to prevent the growth being blown over.

The harvesting of potatoes, onions, pumpkins, and other crops will now keep one busy. This is an operation needing great judgment and care, or all the work of growing the crop is heavily discounted. Just as important is the matter of storage and packing. If the store has not had a good spring cleaning it should be well cleaned up now. There is much virtue in the old-fashioned limewash, and more still if a solution of bluestone be added to it. This makes a good dressing for the walls. The floor of a store requires further attention. It should be scrubbed, or carefully raked out and well moistened with some solution such as formalin, 2 parts to 100 of water, or a solution of bluestone, 1 lb. to 25 gallons water. Quite often the vicinity also will need attention. It is a waste of time selecting produce and then putting it in a store infected with potato-moth, late blight, &c. It will possibly be sold before it goes bad, but buyers soon become aware of the fact that goods from certain stores have a bad knack of

"going off" quickly. A thorough clean-up before the new crop is put away will enable it to be held in condition longer—often a distinct advantage—and raise the reputation of the produce among the buyers. A clean store that is cool and well ventilated will give excellent service.

TOMATO-CULTURE AND ROTATIONAL PRACTICE.

The outside tomato crop will now be well into the harvesting-period. If the plants are at all backward a dressing of soluble fertilizers hoed in when rain is threatening will be of benefit.

The question will soon arise as to the best crop for following on. Too often the ground is neglected for quite a period, which is very undesirable. Much better is it to clean up and burn the old plants and sow a cover-crop, and so get the advantage of the remainder of the growing-season and the considerable amount of manure which remains in the ground. Some growers give the land a good dressing of manure and work the land up for crops of cabbage, lettuce, &c., for early spring cutting. This is a satisfactory succession, except sometimes where a tomato crop is to follow again next season, when the usual heavy manuring again given frequently tells to its disadvantage. The average grower has very generous sentiments as regards expenditure on manures for the land, which is admirable indeed, but evidence is now showing that not only is there an economy but also a benefit to some crops from a more prudent expenditure in this direction.

Regarding the case in question, the cabbage crop probably makes good use of all the manures that are applied, but to follow on with the usual application of fertilizers for the succeeding tomato crop sometimes results in a rank plant that is subject to disease and demands much extra attention. There can rarely be a routine laid down in the matter of applying fertilizers where miscellaneous crops are grown and heavy doses are administered. Careful consideration must be given to the condition of the land from previous dressings and the requirements and peculiarities of the succeeding crop. One of the most urgent problems of the present day in horticulture is to deal effectively and cheaply with land that has been heavily manured and cropped with little or no rotation. To sterilize out the noxious fungi and insect pests is an expensive operation.

One excellent practice observed recently was to sow down the area in tomatoes with grass and clover seed in the month of March, and soon after the plants had finished cropping and had been cleaned up there was an excellent pasture for stock. The property was divided up for this purpose, each section in turn being laid down in grass for three years, giving the land time to recuperate and cleanse itself naturally.

SMALL-FRUITS.

Growers purposing to plant out passion-fruit should sow the seed now, selecting for the seed-bed a piece of good land in a warm, sheltered locality. Thin the seedlings, when they appear, to about 6 in. apart, so that sturdy plants may be available for planting into permanent quarters in the spring.

Some growers of Cape gooseberries prefer to sow seed now, and so have large and early plants for putting out in spring. They will need the protection of a frame during the winter.

Plantings of raspberries, strawberries, currants, &c., will now be completing their growth for the season. Carefully examine the brakes occasionally, and deal with any sign of disease immediately by suitable spraying. Proceed with the preparation of land for new plantings. Remember achievement depends on a good start more than anything else.

THE TOBACCO CROP.

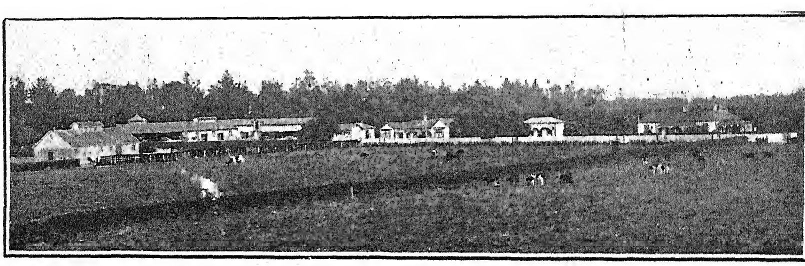
Tobacco crops harvested early will soon be ready for stripping. This stage is reached when the butts of the leaf-stems are well dried out. The plants are then taken from the curing-sticks, and the leaves carefully stripped from them one by one, graded, and tied up into "hands." A hand of tobacco consists of a dozen or so leaves tied together by the stems, the tie used being a tobacco-leaf bound round the stems firmly and the end passed through between the leaves. To do this satisfactorily great care must be taken to have the tobacco in right condition. Generally the dry leaf is brittle, and great damage is done if it is handled then, but if the ventilators are opened up at night or in moist weather the leaf quickly becomes tough and elastic, and the operation of stripping can then proceed.

It is at this stage that the crop is usually marketed in this country, the hands being bulked and afterwards baled up for transport. Otherwise the hands are placed astride of the curing sticks and put back in the shed to await the process of fermentation, which is carried out as the weather warms in spring.

LAWNS AND GREENS.

The warmth and moisture of autumn weather encourages strong growth in lawn-grasses, and those who have the care of playing-greens will now be kept busy cutting and rolling the turf to keep a satisfactory surface. If the turf is poor, applications of manures—liquid or otherwise—at the present time will greatly assist in strengthening the growth. For sowing down new lawns there is no time like the present. The grass comes away rapidly and a good turf is formed before winter, and before weeds have a chance of becoming troublesome. A new lawn disfigured with bad weeds is very disappointing. They may arise from the land not being sufficiently fallowed and cleaned; they may be brought in in the soil used for filling; or they may grow from seed included in the mixture of grass-seeds sown.

—*W. C. Hyde, Horticulturist.*



THE HOMESTEAD, ETC., CENTRAL DEVELOPMENT FARM, WERAROA.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

NATURE OF FOOT-ROT IN SHEEP.

J. HUDSON, Waimimi :—

Would you kindly tell me if foot-rot in sheep is a primary infection, and what cocci one would expect to find in the pus from an affected hoof and in the inflamed tissues near the rot?

The Live-stock Division :—

Foot-rot in sheep is generally considered to be a primary infection, caused by the necrosis bacillus, and following injury or some other agency, such as dampness, whereby the organism can gain entrance to its predilection seat. Other organisms at once take advantage of the necrosed tissue to multiply, and, by their toxic action, cause greater inflammatory changes that would otherwise be caused by the primary bacillus above. Any coccal inhabitants of the soil would thus be present, but those most often found are *Staphylococcus aureus* and *S. albus*.

HOME STORAGE OF APPLES.

A. E. KEMP, Cape Runaway :—

In regard to storing apples for home use, should the fruit be dead-ripe on the trees or will they keep longer if picked just before they are quite ripe? I am proposing to build an apple-house in a shady plantation—a roof with fairly wide eaves, open sides (wire netting), and shelves with straw on, over, and under the apples. Could you tell me any better way of storing apples for the winter?

The Horticulture Division :—

For such storage as you suggest apples require to be quite ripe, but should be picked as soon as that stage is reached. If picked on the green side they are inclined to shrivel. Building the store in an evergreen plantation is a great advantage for the natural insulation and coolness it affords. Spreading apples on shelves with straw for storage is little practised here now, the usual method being to carefully grade out the sound fruit into standard bushel fruit-cases (benzine-cases will do) till they are about three parts full, and then stack them in the store up to about six cases high. Many varieties of apples keep well in this way until the average temperature commences to rise in spring.

CONTROL OF ST. JOHN'S WORT.

"ST. JOHN," Urenui :—

Will you kindly give me some information on St. John's wort? I have a paddock which has got away in this weed. It has been cut but seems to come away stronger again from the roots. It has been heavily stocked with both sheep and cattle. I heard of salt being a good thing, but tried it on a small patch without effect. The paddock cannot be ploughed.

The Live-stock Division (Noxious-weeds Inspection) :—

This creeping weed, which is a perennial, is difficult to eradicate on rough unploughable land, as its roots are deeply penetrating, and form runners from which new growth springs up. Where land can be cultivated, deep ploughing, followed by a crop such as potatoes, turnips, or the like, for two years is considered the most effective method of eradication. In unploughable land probably the only method is to keep it cut and thus prevent it seeding. As it is a fairly heavy seeder it should be cut before the seeds are formed. In some of the drier parts of the Dominion, where the land is stocked solely with sheep, there is little or no trouble with the plant, except on roadsides, as the sheep keep it well cropped. In your case, where cattle are kept also, and where there is a growth

of pasture throughout the year, the stock probably make no appreciable diminution of the plant. There are other means of control, such as spraying with a strong arsenious weed-destroying mixture, but the cost of this would be prohibitive. There is also a danger of poisoning stock after heavy dressings of a poisonous preparation.

ELDERBERRY WINE.

A. J. BOYDELL, Parkhill :—

Will you kindly inform me if white elderberries can be used for wine-making, and do they make as good wine as the red ones ? If the white variety are suitable, what would be a good colouring-matter to make the wine red ? Would cochineal do ?

The Horticulture Division :—

We have no knowledge of the white elderberry being used for making wine. A mixture of caramel and cochineal would be preferable as a colouring-matter to cochineal alone, which gives a carmine colour. A still better and more stable colour could be obtained by mixing a sufficient proportion, for the depth of colour required, of the ordinary elderberries (*Sambucus nigra*) with the white berries.

FLEAS ABOUT OUTHOUSES.

"SUBSCRIBER," Papanui :—

Can you tell me how to get rid of fleas about sheds, fowl-runs, &c. ? I have just bought a place with buildings which have been up some years, though they are in good order. There are large numbers of fleas about somewhere, and I think they must be in the dust of the fowlhouse and sheds.

The Live-stock Division :—

Fleas do not thrive in clean places, but only in corners, &c., where dust and dirt collect. It will therefore be necessary to thoroughly clean up the fowlhouses and sheds (including all corners and cracks) by thoroughly sweeping all walls, floors, &c., and burning or disinfecting and burying all sweepings. After this has been done you should thoroughly limewash the buildings with a wash to which from 1 to 2 per cent. of crude carbolic or one of the standard disinfectants has been added. If it is not convenient to limewash, the buildings should be thoroughly sprayed with a 2½-per-cent. solution of any of the disinfectants. The following has also been found satisfactory as a spray for such purposes: Soft (potash) soap, 5 per cent.; cyllin, 2 per cent.; kerosene, 2 per cent.; water, 91 per cent.; applied with a spray-pump or mop. If you keep fowls it would be advisable to make a sand-bath for them composed of about 4 parts of sublimed sulphur to 96 parts of sand.

SMOTHER-CROP FOR CALIFORNIAN THISTLE.

"SETTLER," Raetihi :—

I have been informed that if cow-grass is sown on land infested with Californian thistle (after ploughing) the thistle will disappear or be choked out by the cow-grass. Could you tell me if this is correct ?

The Fields Division :—

Cow-grass will not choke out Californian thistle or control it to any extent. In districts where lucerne grows well this plant is frequently sown on Californian-thistle areas as a means of control. The heavy growth and the frequent cuttings combine to suppress the thistle.

KAITANGATA COAL-ASHES FOR THE GARDEN.

A. F. MCPHERSON, Christchurch :—

Would you kindly let me know if Kaitangata coal-ashes are of any use to mix with garden-soil ?

The Horticulture Division :—

Coal contains 1 or 2 per cent. of nitrogen, a valuable fertilizer. In ordinary burning it escapes up the chimney, although most of it can be reclaimed in the soot, which forms a valuable dressing for the land. In gasworks, where coal is cooked in an oven (retort), the nitrogen is saved and separated out from the coal-gas, and this is sold to the farmer as sulphate of ammonia. Coal-ashes, where properly burnt, contain only very slight traces of useful fertilizers, being composed chiefly of lime and silica—materials of benefit only to very stiff land, and then only in moderate quantities. Lignites, such as Kaitangata, have a large proportion of sulphate of lime in the ash; an analysis shows 30 per cent. Such ash applied to soils when fresh is injurious to plants, and should first be exposed to the atmosphere and allowed to oxidize.

TWIN HEIFER RETURNING TO BULL.

F. H., Takapau :—

I have twin heifers, a year old, from a cow at her first calving. They were recently put to the bull and one of them comes back every few days. Can you tell me the significance of this? Is she probably barren, and are twin heifers often infertile? Both heifers are of a very feminine type, with well-developed udders.

The Live-stock Division :—

Twin heifers are not as a rule infertile. Infertility, however, often exists in the case of twin calves of different sex. With regard to the trouble you are experiencing with one of your heifers, we would advise obtaining the services of a local veterinary surgeon.

CATTLE-TICK CONTROL IN WAITARA DISTRICT.

FOLLOWING the recent discovery of cattle-ticks at Waitara, Taranaki, the area of land defined as follows has been declared an infected place from which no stock, fodder, or fittings may be removed except under the direction of an Inspector of Stock :—

"All that area bounded by a line commencing at the sea at the mouth of the Waiongona River, following that river to the bridge on the Devon Road; thence by that road to its junction with the Waitara Road; thence by that road in a south-easterly direction to its junction with the Pennington Road; thence along that road to corner of Section 35; thence along the south-eastern boundary of Sections 35 and 36 to the Waitara River, across that river to the Waipapa Road; thence along that road to Elliott Road; thence by the south-western boundary of Subsection 2 of Section 41; thence by the southern boundary of Section 97 to the Nikorima Road; thence in a northerly direction along that road to the sea, and thence by seashore to mouth of the Waiongona River."

HONEY-CONTROL BOARD.

FOLLOWING the bringing into operation of the Honey-export Control Act, Messrs. John Rentoul, Auckland, and Robert Gibb, Menzies Ferry, have been appointed producers' representatives on the New Zealand Honey-control Board. Mr. Thomas Edwin Clark has been appointed as Government representative on the Board.

Top-dressing after Hay-harvest.—Where hay has been cut from a young or weak turf, 2 cwt. to 3 cwt. of superphosphate can subsequently be applied with advantage as soon as a good fall of rain appears imminent.

WEATHER RECORDS: JANUARY, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

RAINFALL was general from the 25th to the 27th, owing to an ex-tropical disturbance passing over the North Island, and some heavy rainfalls were also experienced about the 12th. On the whole, however, the month was rather dry; with the exception of Hawke's Bay, certain Canterbury districts, and the eastern parts of Wellington, the total monthly rainfalls were below the average. The rainfalls about the 26th were most beneficial, and relieved a rather trying time for farmers and graziers in many parts of the country. The weather was remarkably dry in parts of Otago. The last ten days of the month were very unsettled, especially in the northern and east-coast districts; for example, at Maraehako Station, near Opotiki, it rained every day from the 21st to the close of the month, the total rainfall for this period being 8·79 in., of which 2·60 in. and 2·98 in. fell on the 25th and 26th respectively.

Mean temperatures were above the average, but there were cold snaps about the 11th, 17th, and 26th, which did some damage.

Barometric pressure was rather higher than usual, and, though subject to frequent changes, fluctuations were not extreme.

The winds were moderate for the greater part of the month, and the skies rather more cloudy than might have been expected considering the small number of rainy days.

D. C. Bates, Director.

RAINFALL FOR JANUARY, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	3·50	8	1·53	3·36
Russell	1·69	8	0·62	4·54
Whangarei	0·92	8	0·29	3·63
Auckland	2·12	10	0·71	2·59
Hamilton	2·92	6	1·14	3·70
Kawhia	3·56	5	1·30	3·37
New Plymouth	1·48	6	0·65	4·32
Inglewood (Riversdale)	7·01	6	2.41	7·43
Whangamomona	3·31	7	1·63	5·82
Tairua, Thames	3·03	10	0·96	4·12
Tauranga	2·70	10	0·57	4·40
Maraehako Station, Opotiki	11·16	16	2·98	2·87
Gisborne	3·38	15	0·80	2·77
Taupo	5·02	9	1·92	3·46
Napier	2·87	13	0·77	2·44
Maraekakaho Station, Hastings	3·00	14	0·75	2·29
Taihape	3·60	13	1.38	3·03
Masterton	2·86	10	1·43	2·62
Patea	1·63	7	0·75	3·38
Wanganui	2·16	3	1·20	2·84
Foxton	2·84	5	1·40	1·99
Wellington	3·74	9	1·72	3·32
South Island.				
Westport	4·78	10	2·06	6·80
Greymouth	3·40	6	1·50	9·04
Hokitika	4·73	7	2·76	9·87
Arthur's Pass	5·58	6	4·60	6·75
Okuru, Westland	3·78	8	1·30	12·86

RAINFALL FOR JANUARY, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Collingwood	4·69	7	2·34	6·95
Nelson	3·14	9	0·89	2·71
Spring Creek, Blenheim	1·82	7	0·82	2·22
Tophouse	3·26	10	1·16	5·16
Hanmer Springs	3·88	13	1·41	3·30
Highfield, Waiau	3·55	10	1·32	2·84
Gore Bay	2·54	10	0·63	2·47
Christchurch	2·18	7	0·90	2·15
Timaru	1·08	9	0·48	2·28
Ladbrook Station, Fairlie	1·70	7	0·80	2·34
Benmore Station, Omarama	1·69	5	1·02	2·66
Oamaru	0·71	6	0·20	2·15
Queenstown	0·22	2	0·17	2·71
Clyde	0·84	4	0·20	1·72
Dunedin	1·31	6	0·66	3·41
Gore	0·48	5	0·16	3·34
Invercargill	1·01	12	0·28	4·14

WOOL INDUSTRY REGULATIONS AND COMMITTEE.

THE Board of Trade Wool Industry Regulations of 1921 were revoked last month by Order in Council and new regulations substituted, the main provisions of which are as follows: The Minister of Agriculture may appoint a Committee, to be known as the New Zealand Wool Committee, consisting of a Chairman (who shall be a producer), two representatives of wool-brokers, two representatives of wool-growers, and such other persons as he may from time to time decide, to hold office during his pleasure. At any meeting of such Committee three shall form a quorum. The Committee may from time to time determine the maximum aggregate quantities of wool that may be offered for sale by public auction in any period, and may with respect to any specified sale by public auction fix the maximum quantity of wool that may be offered. It shall not be lawful for any person holding a license under the Auctioneers Act to offer wool for sale by public auction, except that he shall have obtained a permit issued by the Committee on behalf of the Board of Trade, and shall have deposited with the Committee an undertaking that he will faithfully adhere to such directions as the Committee may give in writing from time to time to the local Woolbrokers' Association of which he is a member as to the maximum quantity of wool that may be offered at any specified auction sale.

The following Committee has been appointed: W. Perry, Masterton (Chairman); B. E. H. Tripp, Timaru; and R. Silburn, Hunterville (representatives of wool-growers); W. S. Bennett and A. E. Mabin, Wellington (representatives of wool-brokers).

British Market for Peas and Beans.—The following advice was cabled by the High Commissioner, London, on 7th February: *Peas*—Blue: Japanese firmer; ex store quoted at £24 10s. per ton; February-March shipments, £24 17s. 6d.; Dutch ex store, £24. Partridge in poor demand; good English quoted at 55s. to 60s. per 504 lb.; New Zealand, 65s. to 75s.; Tasmanian, 75s. to 82s. 6d. ex store, according to quality. *Beans*—English slow at 45s., to 55s. per 532 lb., according to quality; choice old spring offered up to 65s. Chinese horse spot sold at £10 15s. per ton; forward shipments not being offered.

ESTIMATED YIELDS OF WHEAT AND OATS.

THE following estimated average yields per acre of wheat and oats for the season 1924–25 have been compiled by the Government Statistician from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 9th February :—

District.	Wheat. Bushels per Acre.	Oats. Bushels per Acre.
North Island	29·98	34·00
Nelson	28·90	29·93
Marlborough	30·16	40·46
Canterbury	31·17	36·61
Otago	27·70	36·87
Southland	30·06	42·90
Average (estimated) for the Dominion, season 1924–25	30·62	38·08
Average (actual) for the Dominion, season 1923–24	24·01	30·27

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 5,000,000 bushels, as against an actual yield of 4,174,537 bushels for the season 1923–24.

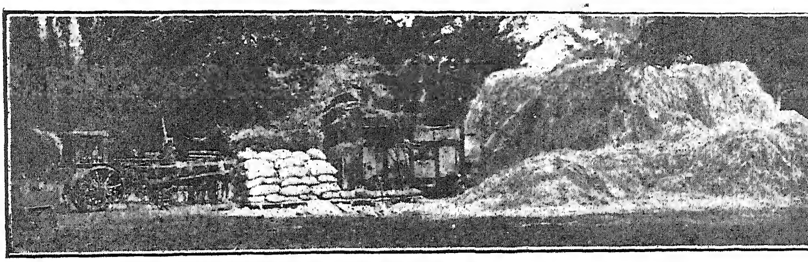
The percentage of oats threshed for the five seasons ending with 1923–24 was 27·67 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 5,000,000 bushels, as against an actual yield of 1,964,511 bushels for the season 1923–24.

IMPORTATION OF FERTILIZERS: DECEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 31st December, 1924: *Sulphate of Ammonia:* From United Kingdom, 150 tons; Australia, 163 tons. *Nitrate of Soda:* Australia, 1 ton. *Basic Slag:* United Kingdom. 133 tons; Belgium, 77 tons. *Bonedust:* India, 600 tons; Australia, 130 tons. *Chardust:* Australia, 100 tons. *Rock Phosphate and Guano:* United Kingdom, 15 tons; New Caledonia, 2,087 tons; Nauru Island, 13,303 tons; Ocean Island, 5,750 tons. *Phosphate, other:* Egypt, 2,762 tons. *Kainit:* United Kingdom, 200 tons; France, 50 tons; Germany, 95 tons. *Superphosphate:* Netherlands, 10 tons *Sulphate of Potash:* United Kingdom, 75 tons; Germany, 125 tons; *Potash, other:* United Kingdom, 140 tons; Germany, 265 tons; France, 25 tons. *Sulphate of Iron:* United Kingdom, 6 tons; Australia, 37 tons. *Miscellaneous:* United Kingdom, 1 ton; Canada, 2 tons.

FORTHCOMING AGRICULTURAL SHOWS.

Waiapu P. and I. Association: Ruatorea, 25th and 26th February.
North Kaipara Agricultural Association: Paparoa, 26th February.
Tauranga A. and P. Association: Tauranga, 26th February.
Franklin A. and P. Association: Pukekohe, 27th and 28th February.
Omaha and Pakiri A. and H. Association: Leigh, 28th February.
Taumarunui A. and P. Association: Taumarunui, 4th March.
Waikato Central A. Association: Cambridge, 4th and 5th March.
Te Puke A. and P. Association: Te Puke, 5th March.
Mangonui A. and P. Association: Kaitaia, 6th and 7th March.
Kumeu District A. and H. Society: Kumeu, 7th March.
Morrinsville A., P., and H. Society: Morrinsville, 11th March.
King-country Central A. and P. Association: Te Kuiti, 12th March.
Matamata A. and P. Association: Matamata, 19th March.
Mayfield A. and P. Association: Mayfield, 21st March.
Methven A. and P. Association: Methven, 26th March.
Katikati A. and P. Society: Katikati, 26th March.
Temuka and Geraldine A. and P. Association: Winchester, 2nd April.
Malvern A. and P. Association: Sheffield, 16th April.



The New Zealand

Journal of Agriculture.

Vol. XXX.—No. 3.

WELLINGTON, 20th MARCH, 1925.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND C.O.R. SYSTEM IN 1924.

W. M. SINGLETON, Director of the Dairy Division.

Certificate-of-record testing results for the calendar year 1924 show an advance over those for the preceding twelve months in number of authenticated records. The average production for the Jersey and Milking Shorthorn breeds has increased, while for the Friesians and Ayrshires the 1923 production has not been maintained.

Climatically, the earlier months of 1924 were very dry, and in January and February some districts experienced what in New Zealand is called a drought. The autumn months compensated to a considerable degree for the inferior producing conditions of the summer months, and dairying districts experienced at that period the best grazing conditions which have obtained for a number of years. The cattle wintered in very good condition, and in the spring and early summer months, closing with the end of the calendar year, conditions were favourable to production above the average. The southern portion of the South Island was perhaps a little less favoured than the majority of the other dairying districts.

During the year another 1,000 lb. butterfat yield was recorded, and six class-leadership productions have been increased. This is very satisfactory, seeing that the leadership figures in many classes have now reached that standard where only outstanding performances can displace them.

CERTIFICATES ISSUED.

The number of cows which have received first-class certificates since the commencement of the C.O.R. system totals 4,180. During the calendar year 1924, 792 cows received certificates on first performances, and 141 cows were certificated on repeat records, making a total of 933 for the year. The following table sets out the position in detail, and figures for the previous year have been included for purposes of comparison:—

Breed.	1923.		1924.	
	Ordinary.	Repeat.	Ordinary.	Repeat.
Jersey	518	51	583	91
Friesian	129	32	148	43
Milking Shorthorn ..	24	6	32	6
Ayrshire	17	3	23	1
Red Poll	3	1	6	..
Shorthorn	1	..	..	..
Totals	692	93	792	141

REDUCTION IN C.O.R. FEES.

As notified in the *Journal* for October, 1924, the Minister of Agriculture has sanctioned a reduction in the fees for testing cows under the certificate-of-record system. The new charges are to come into effect as from the commencement of the next financial year—namely, 1st April, 1925. For all cows calving for commencement of test after that date the fee for the first cow tested each year on any one farm will be £8 8s., instead of £10 10s. as at present. The fee for subsequent entries will remain at the present amount of £3 3s. It is hoped that this new fee will result in the C.O.R. system receiving even stronger support than in the past.

C.O.R. BULLS.

It has been stated many times by the writer that one of the primary objects of a system of testing the yield of purebred dairy cows was to provide information to assist dairymen in the selection of bulls from dams of proven producing-capacity, for the improvement of ordinary-grade and crossbred dairy herds. While the demand for milk and milk-products is growing steadily, it is also true that the margin between cost of production and market values is not increasing. The main opportunity for improving our dairy industry lies in grading up the average dairy herd. Every dairy herd should have its purebred sire from a C.O.R. dam. According to the latest available statistics there are more than thirty-eight thousand dairy herds in New Zealand. On the other hand, taking the total number of purebred bulls of the recognized special-purpose dairy breeds, the latest official statistics show that there are less than nine thousand of these in New Zealand under the heading of "Bulls two years old and over for stud only." So that, despite the increase in C.O.R. testing, we are yet a considerable

distance from providing sufficient bulls of proven strains for use in our average herds. There is reason to believe, however, that dairy-farmers are fast realizing that their success lies in the intelligent use of the proven sire and of the herd-testing outfit. Undoubtedly, the C.O.R. system is gradually attaining its object.

Owing to the steadily increasing number of purebred bulls which, through the authenticated yield of their daughters, are qualifying for our C.O.R. register, it has been necessary to abandon the publication of the full list in this annual review. Under the respective breeds, however, are given the names of those bulls which have not previously appeared, and also those already qualified bulls which have added to their list of certificated daughters during the year.

JERSEYS.

Class-leaders.

During the year under review two out of the five classes into which this breed is subdivided have had the previous highest yield for the class exceeded. In the three-year-olds, Mr. A. Christie's Loo's Queen goes to the head of the list in place of Mr. E. Joyce's Zola of Rosy Creek. In the mature class the same owner's Vivandiere, with 1,036·09 lb. butterfat, displaces Mr. W. H. Miers's Pretty's Flirt, who put 1,010·49 lb. fat to her credit in 1923. Special notes and comments on Vivandiere and her performance appeared in the *Journal* for September last.

The class-leaders at the end of 1924 are shown in the following list :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Alfalfa Pansy ..	F. J. Saxby, Hamilton	2 4	240·9	365	10,898·1	690·16
Senior Two-year-old.						
Marshland's Stylish Princess	W. J. Chynoweth, Hamilton	2 353	275·8	365	9,927·7	715·75
Three-year-old.						
Loo's Queen ..	A. Christie, Tanekaha	3 332	310·2	365	13,422·3	797·32
Four-year-old.						
St. Lambert's Bell ..	A. J. Smith, Cardiff ..	4 283	341·8	365	14,423·1	780·32
Mature.						
Vivandiere ..	A. Christie, Tanekaha	6 10	350·0	365	17,282·1	1,036·09

Jersey Class-averages.

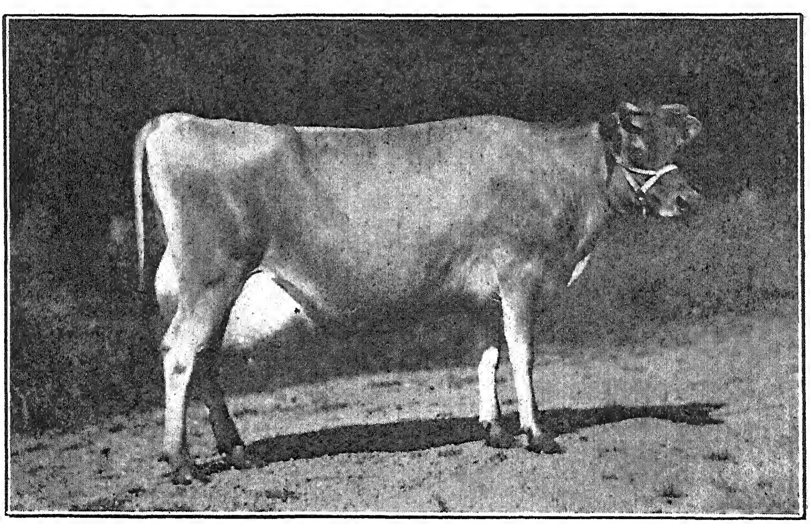
Four classes out of the five into which the Jersey breed is subdivided show an increased average production over the preceding twelve months. A total of 674 cows are represented, as against 569 for 1923. All classes have increased numerically except the three-year-olds, and the class which has fallen off in average yield is the mature.

The decrease, however, is slight—about 5 lb. butterfat—and seeing that some 75 more cows are represented this must be considered satisfactory.

For 1924 the average Jersey is credited with 8,519·9 lb. milk and 468·37 lb. butterfat in an average lactation period of 349 days. This shows an increase of 342·5 lb. milk and 13·24 lb. fat over the previous year, while the average milking-period has advanced by one day.

The class-averages for 1924 and 1923 are given in the following table :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1924.		lb.	lb.
Junior two-year-old ..	253	350	7,417·0	409·80
Senior two-year-old ..	75	353	8,204·1	459·59
Three-year-old	90	348	9,026·9	498·42
Four-year-old	57	348	9,093·0	506·88
Mature	199	347	9,647·7	521·52
	1923.			
Junior two-year-old ..	238	348	7,122·8	397·82
Senior two-year-old ..	63	344	7,991·2	457·13
Three-year-old	99	350	8,636·8	482·08
Four-year-old	45	345	9,044·9	499·07
Mature	124	350	9,614·4	526·64



VIVANDIERE (A. CHRISTIE, TANEKAHA).

Leader of the Jersey mature class, and champion cow of the Jersey breed in New Zealand.

Jersey C.O.R. Bulls.

During the year the Jersey breed added no less than forty-one names to its C.O.R. bulls class, making a total of 181 to date. Of this number 104 bulls have added to their qualified daughters during the year. Their names and particulars of the numbers of their C.O.R. daughters under the various categories appear in the following list:—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1924.

Sultan's Disdain ..	40	9	3	52
Eminent's Fontaine ..	38	4	0	42
Grannie's Knight ..	37	3	2	42
K.C.B.	30	5	3	38
Noble Twylish ..	24	2	0	26
Belvedere Sun Prince ..	19	1	1	21
Te Rapa Lad ..	17	0	0	17
Holly Bank Squire ..	16	2	1	19
Viola's Golden Laddie ..	16	6	0	22
Golden Swan ..	15	4	0	19
Mona's Ally	15	0	0	15
Neathead's Majesty ..	15	3	2	20
Soumise Tom ..	14	2	1	17
The General	14	5	1	20
Bilberry's Goddington	13	3	0	16
Sunflower's Perseus ..	13	3	0	16
Sweet Fox of Collingwood	13	1	0	14
The Owl's Victor ..	13	0	2	15
V.C.	13	0	0	13
Admiral	12	0	0	12
Belvedere Bilberry's Last	12	1	0	13
Good Luck	12	0	0	12
Lady's Duke ..	12	1	1	14
Meadowvale Conqueror	12	1	0	13
Petune's Noble ..	12	0	3	15
Renown of Meadowbrook	12	1	0	13
Charm's Lord Twylish	11	0	0	11
Farleigh Fox.. ..	11	4	1	16
Hawkesbury Emperor ..	11	1	0	12
Miro Meadows Star ..	11	0	0	11
Molina's General ..	11	3	0	14
Lord Twylish ..	10	0	0	10
Rose's Attraction's Fox	10	0	0	10
Rozel's Sultan ..	10	0	0	10
Soumise Majesty ..	10	1	0	11
Belvedere Jersey Boy ..	9	1	1	11
Charm's Lord ..	9	0	1	10
Grand Master* ..	9	2	0	11
Maid's General ..	9	1	1	11
Peggy's Campanile ..	9	0	1	10
Rainbow's King ..	9	1	1	11
Twylish Hope ..	9	1	0	10
Beachland's White Swan	8	0	0	8
Eileen's Fox ..	8	2	0	10
Maid's Noble General ..	8	1	0	9
Maori Captain ..	8	0	0	8
Masterpiece of Meadowbrook	8	0	0	8
Owler of Puketapu* ..	8	0	1	9
Cambridge Rata King*	7	0	0	7
Chief of Jersey Meadows	7	1	0	8
Flandrine's Swan ..	7	1	0	8
K. See 18th* ..	7	0	0	7
Lord Nelson	7	1	1	9
Mere's Conqueror ..	7	0	1	8
Protection of Meadowbrook	7	0	0	7
Shamrock of Beachlands	7	1	0	8
Sherry's Fox of Collingwood	7	1	1	9
Sunglow	7	1	1	9
Waipiko Masterpiece* ..	7	0	0	7
Bridge View's Magnet*	6	0	0	6
Centurian*	6	0	0	6
General Noble ..	6	0	0	6
Miro Meadows Maori Boy	6	1	0	7
Noble Sultan ..	6	1	0	7
Signor	6	0	0	6
Beachlands King Pin*	5	1	0	6
Belvedere Sun King ..	5	0	0	5
Bright Knight* ..	5	0	1	6
Fox's Top*	5	1	0	6
Golden Fox* ..	5	0	0	5
Golden Swan's Lad ..	5	0	0	5
Hawkesbury Majestic*	5	0	0	5
Napper	5	0	0	5
Oakdale Major* ..	5	1	0	6
Pecuarius*	5	0	0	5
Perfection's King* ..	5	2	0	7
Reid Park's Lord* ..	5	0	0	5
Una's Nobility ..	5	0	0	5
Vulpes of Bulls ..	5	0	0	5
Waipiko Josiah* ..	5	0	0	5
Woodstock's Lord Raleigh*	5	0	0	5
Beachland's Admiral* ..	4	0	0	4
Beachland's Leo* ..	4	0	0	4
Belvedere Bilberry's Bob* ..	4	1	0	5
Cherry's Squire* ..	4	1	1	6
Darkie Bill*	4	2	0	6
Darkie's Fox 2nd* ..	4	1	0	5
Dewdrop's Monarch* ..	4	0	0	4
Elf of O.K.* ..	4	0	0	4
Enigma's K.C.* ..	4	1	0	5
Gold Crown*	4	0	0	4
Hillcrest's Record* ..	4	1	0	5
Ironmaster of Meadowbrook*	4	0	1	5
King of Jersey Holme*	4	1	0	5
Majestic Duke* ..	4	0	0	4
Majesty's Squire* ..	4	0	0	4
Middlewood's Eminent*	4	0	0	4

Jersey C.O.R. Bulls—*continued.*

Miro Meadows Major* ..	4	0	0	4	Molly's Lad*	4	0	0	4
Miro Meadows Quickshine*	4	0	0	4	Rimu*	4	2	0	6
Miro Meadows Toby* ..	4	0	0	4	Royal Tar*	4	2	0	6
					Snowshower* ..	4	0	0	4

FRIESIANS.

Class-leaders.

No change was made this year in the list of Friesian class-leaders as at the end of 1923. The leadership records for the breed have now reached a very high level, and only quite exceptional performances could displace the present leaders. During the year, however, some noteworthy yields have been authenticated. Messrs. C. R. Duncan and Sons' senior two-year-old Mutual Stella de Kol gained a certificate for 720·43 lb. butterfat. In the senior four-year-olds Mr. T. R. Eades's Hinemoa Beauty (see last month's *Journal*) produced 822·37 lb. fat, and in the mature class Mr. J. Hart's Lady Pauline yielded 850·66 lb., the highest Friesian production of the year.

The class-leadership list holds good for 1924, as follows:—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old. Netherland Princess 4th	John Donald, Westmere	2 341	274·6	365	19,621·6	805·77
Junior Three-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old. Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·9	863·51
Junior Four-year-old. Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old. Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

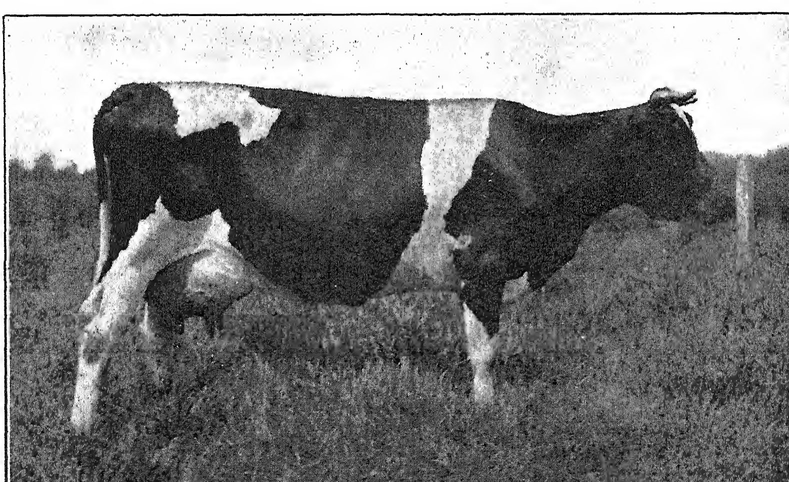
Friesian Class-averages.

With the exception of the junior three-year-olds the 1924 Friesian class-averages show decreases as compared with the figures for the previous year. There were 191 Friesians under test in 1924, so that, when divided into the seven classes which the breed recognizes, the

number of cows per class is small, and thus the averages are considerably affected by the yields of individual cows. The 191 cows on test gave an average production of 14,070·3 lb. milk, containing 486·09 lb. butterfat, the average milking-period being 346 days. This represents a decrease of 30·28 lb. fat and 688·8 lb. milk, the average lactation period having decreased by four days.

The figures for 1924 and 1923 are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1924.		lb.	lb.
Junior two-year-old ..	51	355	11,516·8	400·04
Senior two-year-old ..	31	352	13,286·0	472·86
Junior three-year-old ..	24	336	13,637·3	471·33
Senior three-year-old ..	11	342	14,502·7	499·93
Junior four-year-old ..	11	347	15,293·2	541·69
Senior four-year-old ..	7	332	15,462·1	501·42
Mature	56	340	16,516·5	562·54
	1923.			
Junior two-year-old ..	50	345	11,435·4	406·27
Senior two-year-old ..	16	348	14,343·4	497·45
Junior three-year-old ..	15	347	12,572·7	445·21
Senior three-year-old ..	11	355	16,253·1	583·27
Junior four-year-old ..	11	353	16,086·6	565·28
Senior four-year-old ..	17	357	17,516·6	604·07
Mature	41	353	17,878·2	616·19



LADY PAULINE (JAMES HART, TATUANUI).

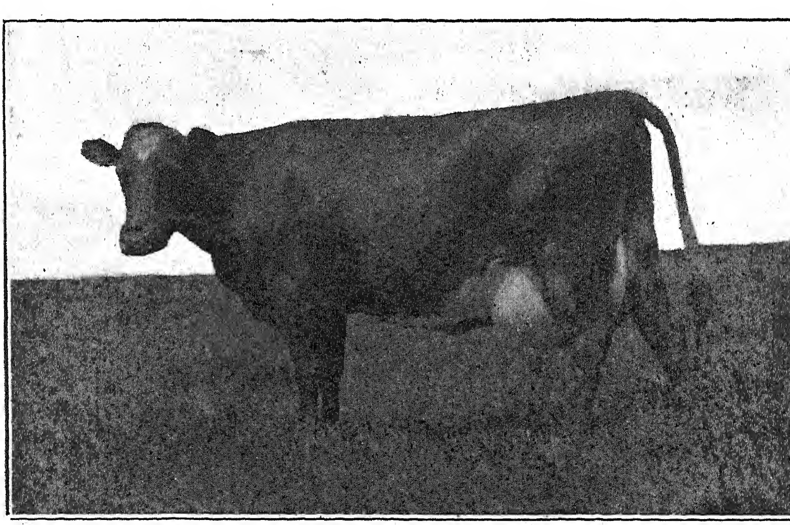
C.O.R. in Friesian mature class: 25,306·2 lb. milk, 850·66 lb. butterfat; highest Friesian record for 1924.

Friesian C.O.R. Bulls.

Up to the end of 1924 some seventy-five Friesian bulls have qualified for the C.O.R. list. During the year nine new names were added, and twenty of the bulls previously qualified increased the number of their C.O.R. daughters. The list is as follows :—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1924.

Woodcrest Joe ..	19	10	0	29
King Fayne Segis 2nd..	17	5	0	22
Woodcrest Hengerveld Mechtilde	16	3	2	21
Mutual Piebe of Rock..	11	3	0	14
Royal King Champion	11	2	0	13
Woodcrest Pietje Pontiac	11	1	0	12
Woodcrest Pietje Alcartra	10	2	2	14
Dominion Woodcrest Piebe Mercedes ..	9	1	0	10
Rosevale King Sylvia ..	9	1	3	13
Rosevale Korndyke Sylvia Posch	9	9	1	19
Colantha Segis Lad* ..	8	0	0	8
Longbeach Big Patch ..	7	1	0	8
Marquis Segis Colantha	7	1	1	9
Dominion Dutchland ..	6	1	0	7
Dominion Woodcrest Lulu Champion* ..	6	1	0	7
Friesland Dirk ..	6	1	1	8
King Alcartra Rose de Kol	6	3	0	9
Rex de Kol of Sunnycroft	6	2	0	8
Salma Torohunga No. 1	6	0	0	6
Cordyline Hero ..	5	1	0	6
Dominion Woodcrest King Segis of Rock*	5	0	0	5
Friesland Park Von Bulow	5	0	0	5
Marquis Piebe de Kol ..	5	0	0	5
Royal Prince Pietertje de Kol*	5	0	0	5
Star of Canada* ..	5	0	0	5
Friesland Korndyke Segis* ..	4	2	0	6
King Rose de Kol* ..	4	0	1	5
Medbury Prince ..	4	1	2	7
Pietertje Netherland Paul*	4	1	1	6



GLENTHORPE LADY (A. J. MELVILLE, BUCKLAND).

Leader of the Milking Shorthorn mature class.

MILKING SHORTHORNS.

Class-leaders.

The list of Milking Shorthorn class-leaders shows three changes for the year. In the junior three-year-old class Dominion Carnation of Ruakura, with 439·20 lb. butterfat, gives way to Matangi Quality 4th, owned by Messrs. Ranstead Bros., who brings the leadership figures to 678·02 lb. fat—an increase of 239 lb. The senior four-year-old Matangi Ruth 2nd, also owned by Messrs. Ranstead Bros., defeats last year's leader—Mr. R. S. Allan's Sweet Garnett 2nd of Cornwall Park, with 514.19 lb. fat—by some 130 lb. In the mature class Mr. A. J. Melville's Glenthorpe Lady, with the fine yield of 856·85 lb. fat, defeats the long-standing champion, Maniaroa Princess, by no less than 156 lb.

The Milking Shorthorn class-leaders now stand as follows:—

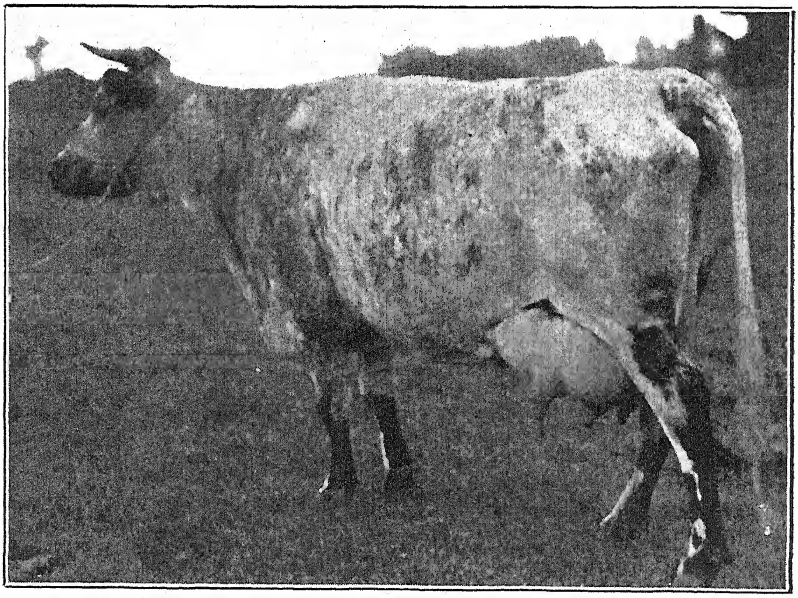
Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Birkland Dainty ..	G. N. Bell, Palmerston North	2 281	268·6	365	11,616·9	459·98
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Nancy 2nd	Ranstead Bros., Matangi	4 3	313·8	365	15,591·6	608·28
Senior Four-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class-averages.

Thirty-eight Milking Shorthorns were certificated in 1924, as against thirty for 1923. Three of the seven classes show increases in average production. The class-membership for this breed is so small, however, that the averages are too much effected by individuals to be of very great value. One class contains only two animals, two classes each have three representatives, two have four, one has six, and the remaining class—the mature—sixteen. This being so, the truest comparison is obtained by comparing the sixteen mature animals of 1924 with the sixteen in the same class for 1923. There is here shown an increase of 62 lb. butterfat, which must be considered very satisfactory. The average tested Milking Shorthorn cow of 1924 gave 11,738·8 lb. milk, containing 481·30 lb. fat, in an average milking-period of 346 days.

The class-averages for 1924, together with those for the previous year, are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1924.		lb.	lb.
Junior two-year-old ..	6	344	8,372·0	337·77
Senior two-year-old ..	3	350	7,478·8	302·35
Junior three-year-old ..	3	354	12,722·7	523·81
Senior three-year-old ..	4	352	12,133·4	508·36
Junior four-year-old ..	2	365	11,179·3	435·16
Senior four-year-old ..	4	349	12,846·1	574·19
Mature	16	341	13,310·1	536·50
	1923.			
Junior two-year-old ..	6	352	12,145·8	459·69
Senior two-year-old ..	2	336	8,750·3	337·39
Junior three-year-old ..	2	301	7,945·4	309·97
Senior three-year-old ..	1	365	14,032·7	747·86
Junior four-year-old ..	2	365	12,892·0	494·14
Senior four-year-old ..	1	365	16 260·3	514·19
Mature	16	340	11,860·7	474·65



MATANGI QUALITY 4TH (RANSTEAD BROS., MATANGI.)
Leader of the Milking Shorthorn junior three-year-old class.

Milking Shorthorn C.O.R. Bulls.

Four bulls of this breed have now qualified for the C.O.R. list, the name of Marlborough of Darbalara (Imp.) having been added during the year under review. Of the bulls previously qualified one failed to add to his list of C.O.R. daughters since our last annual review. Particulars are as follows: Dominion Esau of Ruakura, 12—1—1—14; Dilworth Baronet, 5—0—0—5; Marlborough of Darbalara, 4—0—0—4 (key to numbers as given with Jersey bulls).

AYRSHIRES.

Class-leaders.

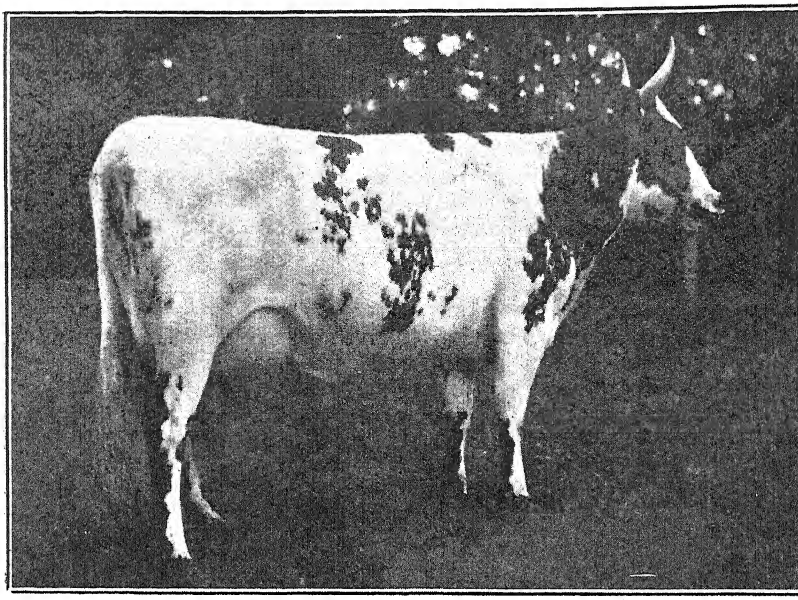
For the Ayrshire breed only one change has been made in the highest performance for each class, this falling in the three-year-olds. The previous leader was Mr. C. E. C. Webb's Greenfield's Ina, with 566·02 lb. butterfat. Mr. A. M. Weir's Ivanhoe Stylish Daisy now raises the record to 574·09 lb. The table of class-leaders is as follows:—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old. Dimple of Edendale	W. Hall, Lepperton ..	2 327	273·2	365	13,063·3	529·46
Three-year-old. Ivanhoe Stylish Daisy	A. M. Weir, Menzies Ferry	3 312	308·2	365	12,334·2	574·09
Four-year-old. Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature. Ivanhoe Fillpail ..	A. M. Weir, Menzies Ferry	..	350·0	365	16,362·7	646·31

Ayrshire Class-averages.

Twenty-four Ayrshires gained certificates during the year, as against twenty in 1923. The average production of the twenty-four was 431·58 lb. fat, from 10,419·4 lb. milk, in 354 days. The Ayrshire class-averages for 1924 and 1923 are as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1924.		lb.	lb.
Two-year-old	6	354	7,025·0	297·01
Three-year-old	3	363	11,932·4	519·03
Four-year-old	3	355	11,603·6	471·87
Mature	12	353	11,442·2	466·93
	1923.			
Two-year-old	4	365	10,986·1	438·63
Three-year-old	2	365	11,036·2	458·40
Four-year-old	4	365	11,166·2	500·52
Mature	10	353	12,663·0	530·19



IVANHOE STYLISH DAISY (A. M. WEIR, MENZIES FERRY).

Leader of the Ayrshire three-year-old class.

Ayrshire C.O.R. Bulls.

The Ayrshire bulls which have qualified for the C.O.R. list now number six. The name of Hindsward Jimmie of Townhead has been added during 1924, and he is the only bull of the breed eligible for inclusion in this year's review. Hindsward Jimmie of Townhead has six first-class C.O.R. daughters to his credit, one of which has gained a certificate on a second performance. It is worthy of mention that with the exception of Dimple of Edendale, leader of the two-year-olds, all class-leaderships for the Ayrshire breed are held by daughters of this bull.

RED POLLS.

Class-leaders.

Although the Red Polls are not generally recognized as a special-purpose dairy-breed, they have nevertheless made a number of creditable butterfat yields. The only Red Polls which have been placed under C.O.R. test are from the herd of the Agriculture Department's Central Development Farm, Weraroa. Up to the end of 1924 twenty-nine cows have received certificates, and eleven of these have gained a

C.O.R. on second or subsequent performances. The highest yields for each class are shown in the following table :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Dominion Sylphide ..	Central Development Farm, Weraroa	1 339	240·5	341	8,651·1	430·74
Three-year-old.						
Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Dominion Opticia ..	Central Development Farm, Weraroa	4 343	347·8	365	9,958·50	441·27
Mature.						
Dominion Sylph ..	Central Development Farm, Weraroa	5 4	350·0	365	11,009·00	505·84

Red Poll Class-averages.

Six Red Polls gained certificates last year, all being from the Central Development Farm herd at Weraroa. The number is not sufficiently large to warrant a table of class-averages, but it may be noted that the six cows averaged 7,391·2 lb. milk, containing 346·76 lb. fat, in 323 days.

SECOND-CLASS CERTIFICATES.

The second-class certificates still remain at a very small proportion of the total certificates issued. During 1924 second-class certificates were issued to thirty-two Jerseys, fifteen Friesians, and one Milking Shorthorn. The average production of these Friesians was 521·71 lb. butterfat, and of the Jerseys 510·30 lb.

EXPORT OF PUREBRED DAIRY CATTLE.

The value of purebred dairy cattle exported has been maintained. During the calendar year 1924 a total of 178 head were exported, their entered total value being some £8,635. Comparative figures for the previous year are 203 animals, and £8,650. The values therefore remain about the same, although the number decreased by twenty-five. Among those exported were several animals of high value, notably some Friesians from the stud of Mr. W. D. Hunt. The majority of the animals went to Australia and to the Pacific islands.

APPRECIATION.

The thanks of the Dairy Division are once more due to the secretaries of the various breeders' associations concerned—Messrs. W. M. Tapp (Jersey Cattle Breeders), M. J. Thomson (Friesian), William Hunter (Milking Shorthorn Breeders), and R. H. Spencer (Ayrshire Cattle Breeders)—for their cordial assistance in connection with the work of C.O.R. testing.

CLOSING LIST OF RECORDS FOR 1924.

The appended list, containing only eight names, completes the publication of particulars of certificates issued during the calendar year 1924:—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Alfalfa Senorita ..	F. J. Saxby, Hamilton	1 247	240·5	365	11,114·1	591·68
Woodstock Free Lady	Mrs. Banks and Son, Kiwitea	1 309	240·5	365	7,729·0	427·30
Senior Two-year-old.						
Spec's Girl ..	A. J. Harris, Bombay	2 327	273·2	365	11,560·1	661·03
Three-year-old.						
Alberta's Pansy ..	R. Waterhouse, Ardmore	3 123	289·3	365	9,179·5	527·53
Four-year-old.						
Hawkesbury Ladyship	S. J. Goulter, Haumoana	4 360	349·5	328	9,450·2	450·82
Genii	C. Stevens, Maungatapere	4 46	318·1	330	6,740·9	413·69
	MILKING SHORTHORNS.					
Mature.						
Riverdale Nectarine†	T. W. Wardlaw, Waimana	..	350·0	293	11,765·2	412·62

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
	FRIESIANS.					
Junior Two-year-old.						
Fencourt Princess† ..	J. H. Jamieson, Cambridge	2 2	240·7	365	11,142·5	380·23
Junior Four-year-old.						
Rosevale Princess Lassie*	H North and Sons, Omimi	4 31	316·6	365	16,237·7	600·29

* Milked three times daily during whole lactation period. † Milked three times daily during part of period.

Correction.—In the December C.O.R. list (January *Journal*) the four-year-old Jersey cow Volpe's Streamlet was shown as having been milked three times daily during part of her lactation period. This cow was milked only twice daily during the whole of her period on C.O.R. test.

Proposed Blackberry Boards.—At the meeting of the Board of Agriculture held last month the following resolution was passed for submission to the Minister of Agriculture: "That legislation be framed to enable Blackberry Boards to be formed in a similar manner to the small-area Rabbit Boards established under Part III of the Rabbit Nuisance Act, 1908. The question as to whether the operations of the Blackberry Boards, if established, should be extended to include control of all noxious weeds is also worthy of consideration."

ELECTRIC POWER TRANSMISSION POLES.

EUCALYPT SPECIES FOR NEW ZEALAND CONDITIONS.

J. H. SIMMONDS, Takanini, Auckland.

NEW ZEALAND needs increasing thousands of supports for carrying electric wires. In theory, the supports may consist of reinforced concrete, or bolted steel bars, or wood. In practice, general preference is being given, and seems likely to be given, to wood. The concrete pole is heavy and easily fractured. The steel tower may come into favour for main lines; it may be best for very steep country where material can be delivered in sections more easily than in long lengths; but for the rapidly expanding reticulations it apparently cannot compete in economy and convenience with the wood pole.

The wood poles now being distributed by our engineers for the new power-lines, though so crude and plain, bear impressive witness to the genius and progress of civilized man. They tell of learned research into the secrets of nature, and of well-instructed planning to convert the energy of falling water into light and heat and mechanical movement. They tell of forests and skilled woodmen in far-off Australia. They tell of freighted ships crossing the Tasman Sea, and of strong-limbed men and powerful appliances doing the work of landing and distribution in our own country. A hundred years ago British men were here gathering kauri spars for the masts and yards of ships; to-day we are importing hardwood poles for the transmission of electricity. As we still look at these great shafts of wood and try to estimate their cost we find ourselves asking why they are being brought from Australia instead of being grown in our own forests. The question is pertinent and must be competently answered.

The botanical genus that yields these poles has been made known to the world under the strange Greek compound *Eucalyptus*. It is a genus unique and apart in the earth's manifold flora. It belongs to the great myrtle family, but is easily distinguished from all other myrtles. In multitude of species it holds second place only to the genus *Acacia*. Though restricted in natural habitat to the island continent of Australia and adjacent islands, it is unsurpassed in climatic range by any single genus of the forests — indigenous and locally adapted species being found in every available climatic region from the southern capes of Tasmania to the tropical jungle of New Guinea, and from genial lowlands on the seaboard to alpine heights above the winter snow-line. Some of the species are humble shrubs; some are bushy mallees. At least one hundred are timber-yielders of medium to large dimensions, and of these twenty or more easily hold place in the first rank of forest giants. Many are very beautiful, and from the foliage of a large number there may be extracted fragrant and valuable essential oil.

As exotics distributed by the hand of man many of the species are showing wonderful capacity for acclimatization. Planting was begun in countries outside of Australia over sixty years ago; and, speaking generally, it has since then been continued with steadily increasing enthusiasm and success. Many countries have contributed

to useful and progressive experiment. Selecting from the long list, we may perhaps especially mention Algeria, South Africa, California, and our own New Zealand.

LIMITATION OF RANGE.

Like the now greatly appreciated *Pinus radiata* and *Cupressus macrocarpa*, the eucalypts have had to win their way against lack of knowledge and much prejudice. For a long time it was commonly assumed that there were only a few sorts of "gum-trees," as they were called, and that "gum-tree" seed collected anywhere in Australia could be propagated anywhere in New Zealand. We know now that the genus *Eucalyptus* has during its long history branched and evolved into over three hundred and fifty quite distinct specific forms. We further know to-day that each species has a climatic and geographical range within which it finds its optimum or best development, and beyond which it declines in vigour and ultimately dies out. For one species the range may be narrow, for another very wide, but for each there are limits. Even now the eucalypts are not nearly well enough understood for winning best results in cultivation on a large scale. If we are to avoid the errors of the past and to put the growing of these trees on a footing of practical certainty we must begin by competently studying the problem of climatic adaptation. No economic merits of a species will count if we plant that species where nature has predetermined that it shall not flourish.

Much the most important and restrictive factor in the limitation of the range of eucalypts is temperature. Exceptional extremes of heat or cold may inflict serious injury, but they are followed by recovery. It is the mean annual temperature that constitutes the insuperable barrier, and so imperious is nature in this matter that the cold-country tree and the warm-country tree cannot under any circumstances change places without serious loss of vigour and possible extinction to both. The number of days per annum upon which the sun shines through a clear sky, though less understood, is also very important for some of the species. The second master factor in the limitation of range is rainfall. All the large-growing species require from 30 in. to 60 in. of rain per annum for their best development. Inland species of smaller dimensions can survive and yield valuable poles, fencing-posts, and fuel with as little as 20 in. or even 15 in. of fall. Chemical constitution and physical condition of the soil and subsoil are very important, but these are repeated in different climatic zones and must be separately considered for each species.

In studying climatic conditions we must always remember how the problem is affected by both latitude and altitude. The general law is that as a species extends its range to higher latitude or away from the Equator it must descend to lower altitude, and, reversely, that as it extends its range to lower latitude or towards the Equator it must or may ascend to higher altitude. Thus, if we find a species flourishing at an altitude of 1,000 ft. to 1,500 ft. in Central North Island we shall not expect to find it in a similar condition at that altitude in Otago and Southland, but somewhere within a hundred feet of sea-level, and *vice versa*. Species that find their optimum on warm lowlands north of about latitude 38 will be barred from extending

southward at all unless at the cost of vigour and size. Apparent exceptions to the general law arise from local contour of the land. In nearly all groups of low foothills there are limited areas where at night the cold air falls to the lower levels and forces the warm air up to the knolls and small plateaux. Many such relatively warm patches may be found in both the South and the North Islands. They slightly extend the possible range of tender species, but do not negative the general law. Sea-breezes modify temperature; but, unless they are first arrested by screens of hardy conifers, they are usually too saline and too persistent for the young foliage of *Eucalyptus* trees.

SUCCESSES AND FAILURES IN NEW ZEALAND.

Power Boards, local bodies, and private owners of land intending now to make plantations of eucalypts must accept the climatic conditions imposed by nature upon these and all other trees. Conflict with nature does not pay. If a Power Board wished to plant, say, 500 acres of pole-timber trees as a source of supply for its future necessities, what is to be the procedure? Choice lies between the haphazard practice of the past and a practice based upon sound deductions from all available sources of information and guidance. Two generations of people in this country have planted eucalypts or have seen them planted. In a large number of cases the results have been splendid and wonderful. The trees have grown as if by magic, and have in an incredibly short period of time reached very large dimensions. In both Islands heavy crops have already been reaped and utilized. Poles, fence-posts, sawn timber, and fuel in great quantities have been derived from relatively very small areas of land. Had all the eucalypts planted in this country during the last fifty years done equally well there would have been no need now to import poles from Australia.

But in every region of the Dominion there have been failures, the total sum of which has amounted to a great national loss. If we are to put the enterprise on a sounder footing for the future the causes of failure must be candidly and fearlessly laid bare. It is an ungracious task to chide dead men, but it must be said here that in earlier years seed-collectors, seed-vendors, and nurserymen were too often not reliable in the matter of *Eucalyptus* seeds and plants. Charity will say that they lacked knowledge for this particular branch of their work, and will further excuse them by saying that in those times even botanists were not always sure of their ground. We are concerned just now with what happened to the tree-planting interest. Seeds were often collected from relatively useless trees and sold under wrong names. The enthusiast who sowed these seeds in anticipation of becoming the proud owner of a noble patch of forest found himself instead, after twenty years of waiting, in possession of a promiscuous collection of shrubs and low-branching trees with crooked stems. In other cases the seed was right, but the localities chosen for the planting were wrong. Catalogues made an eloquent story about the merits of jarrah, spotted gum, and broad-leaved ironbark, but failed altogether to inform the planter that these and some other valuable species were exceedingly exacting in respect to climatic conditions. One gentleman planted about thirty valuable but tender species at a

high altitude in Canterbury and lost them all. Had this planting been done in the Marlborough Sounds or on warm lowlands of the North Island most of the species would now have been yielding poles for carrying wires and logs for the sawmill.

SPECIES FOR WIRE-CARRYING POLES.

There are at least sixty timber-yielding species of *Eucalyptus* that can be grown somewhere and to some extent in New Zealand. To the timber list there may be added a large number of ornamental species of smaller dimensions. In a handbook which the writer hopes soon to publish all the most important of these species will be given detailed description, with notes on climatic requirements and uses of the trees. The purpose of the present article is to meet an urgent demand for information that will enable local bodies, syndicates, or private owners of land to start plantations for the production of wire-carrying poles.

The task of selection will be made easier if we place the several available species in groups. For those who are not botanists the most convenient basis for grouping is bark. The living bark of *Eucalyptus* trees, like that of many other trees, is always gradually changing into dead bark. The dead bark may cling to the tree, or it may fall away, leaving the living bark bare; it may be stringy, fibrous, sub-fibrous, or entirely non-fibrous; it may be soft or hard. On this bark basis we easily form five groups, as follows: (1) Stringy-barks, (2) gums, (3) woolly-butts, (4) ironbarks, (5) boxes. The order in which the groups are here placed is determined by value of the crop they can return to us in New Zealand. Two factors enter into the value of a timber-tree—(*a*) Quality and durability of the mature wood, (*b*) rapidity and abundance of its production. The best tree is that which most completely combines both factors, and the best group is that which includes the largest number of such trees. The stringy-barks and gums are placed first because they are the groups that can produce the largest quantity of good timber in the shortest period of time; the ironbarks and boxes come last because, although their mature wood is of exceedingly high merit, their prospective productivity is low.

STRINGY-BARKS.

The term "stringy-bark" is here used in the widest sense, so as to include all the eucalypts whose dead bark is distinctly fibrous or stringy. So numerous and so generally valuable are the members of this group that it would be easy to write a pamphlet about them. In this article on trees for electric power transmission poles we must be content to mention a few.

Eucalyptus pilularis.—This species has dead bark persistent on the stem only, fibrous but not stringy; leaves in juvenile stage sessile (without stalks), lance-shaped, richly coloured, on adult trees deep green and shiny on upper surface; seed-cups about ⅜ in. in width; mature wood pale, easily worked, strong, durable in the ground. The species has its native home in warm parts of eastern Australia. It was introduced into New Zealand about fifty years ago, and is now represented by vigorous millable specimens on the Auckland Isthmus, in three separate plantations near Papakura, and in two localities in the Hawke's Bay District. The trees grow rapidly to a large size, and, if intended for power-line poles, must be matured in close stands. In the seedling stage

E. pilularis is very sensitive to frost, and it is a bad transplanter. Wherever practicable, therefore, seed should be sown on thoroughly cultivated ground where the trees are to grow, a very light sprinkling of Italian rye-grass being sown with it to protect the plants against frost in their first winter. For unploughable country the plants must be so prepared in boxes or pots that they may be transferred to the permanent ground with soil about their roots.

(2.) *E. eugenioides*.—Has dead bark distinctly stringy, persistent from ground to small branches; leaves in juvenile stage brown, hairy, creased, on older trees smooth and somewhat shiny; seed-cups $\frac{1}{4}$ in. to $\frac{5}{16}$ in. in diameter, on short stalklets, in crowded heads; mature wood pale or pinkish, straight in grain, easily split, excellent for sawing into boards, much valued for posts and poles, resistant to fire. The species has its native habitat in eastern Australia, from south to north through Victoria, New South Wales, and southern Queensland; from east to west over the lowlands, tablelands, and mountains. It has found a congenial home in New Zealand, as witnessed by numerous specimens of millable size in the Papakura-Clevedon district near Auckland, in the State forests at Whakarewarewa, in the Waikato near Cambridge, and in the Wairau Valley, Marlborough. Many trees have been felled and utilized with results that well sustain the Australian reputation of the timber for durability in the ground. Grown in close stands *E. eugenioides* sheds its side branches and forms long, straight stems in every way suited for carrying electric wires. Seed for future plantings should be obtained either from our own acclimatized trees or from certified and approved trees in cold parts of the natural habitat. The species is one of those that give their best results when seed is sown on quite clean, well-cultivated land where the trees are to grow. For propagation by transplanting the plants must be prepared as recommended for *E. pilularis*. In the young stage seedlings of these species require especial care to prevent overtopping and suppression by weeds and grass. A little blood-and-bone manure mixed with the soil near each plant will promote a rapid start and greatly reduce the risk of failure.

(3.) *E. Muelleriana* and *E. laevopinea* are two species similar in botanical characters and in economic merits to *E. eugenioides*. *E. Muelleriana* is represented by vigorous specimens of pole-timber size in the State plantations near Rotorua, and by younger specimens in a few localities. *E. laevopinea* has only recently been introduced. Both species are worthy of experimental plantings in medium climatic conditions, but, until further tested, neither can be recommended for cultivation on a very large scale in this country.

(4.) *E. gigantea* (syn. *E. delegatensis*) is a mountain stringy-bark that should be given trial in small plantings where climatic conditions become too severe for *E. eugenioides*.

GUMS.

Eucalypts were first called "gums" in reference to the gum-like kino that exudes from the stems and large branches of many species. Later the term was restricted by Australian woodmen to those species that shed their dead bark and present a more or less smooth surface.

(1.) *E. corynocalyx* (syn. *E. cladocalyx*).—The dead bark comes off

with oily lustre ; seed-cups about $\frac{1}{2}$ in. long by $\frac{3}{8}$ in. wide, barrel-shaped, striped ; mature wood brown to dull yellow, hard, and very lasting. The species is cultivated as a pole-yielder in South Australia and Victoria. Many scattered specimens are doing well in warm parts of New Zealand. At a place called Fern Glen, near the coast in northern Wairarapa, there is a stand of about 9 acres, many units of which are now large enough for carrying wires. The species merits persistent experiment in similar situations. Sowings should be made *in situ* on well-prepared land with seed from best acclimatized trees.

(2.) *E. saligna*.—The dead bark is deciduous from branches and stem, newly exposed living bark greenish or bluish ; leaves deep green, shiny on upper surface ; seed-cups about $\frac{1}{4}$ in. long, much narrower at the base than at rim ; mature wood red, clean in grain, easily worked, excellent for building-construction, durable in contact with the ground. The natural habitat is the coastal belt and gullies of the tablelands in New South Wales and Queensland. As an exotic in our country *E. saligna* is proving hardier than the conditions of its native home would have led us to expect. Healthy and vigorous specimens have been noted by the writer in many North Island plantations. In the Waikato, near Cambridge, and Upper Tutaenui, near Marton, there are large millable trees. Seedlings are now reported to have survived their first winter at Taihape. It is a fair inference to assume that this beautiful and valuable tree would flourish in sheltered parts of the Marlborough Sounds and in Nelson. Grown in close plantations it rapidly develops long clean poles that will be fit for cutting in thirty years.

(3.) *E. globulus*.—This is the Tasmanian "blue-gum," and is too familiar in New Zealand to need description. It is a tree that has suffered in reputation through bad treatment and consequent prejudice. Properly understood and in its proper place it is very valuable. It requires a climate that is cold without alpine severity, and a soil that is deep and moist without being wet. We erred when we planted this tree on warm lowlands of the North Island ; we also erred when we planted it on dry uplands. Our error exposed the tree to disease ; and then, instead of blaming ourselves, we discredited the tree. The optimum of the species in New Zealand has been found at low altitudes on alluvial flats in the South Island. Planted there in close stands it grows with great vigour, and soon develops heavy crops of tall, straight poles of great value. When quite mature, felled in the winter, and properly seasoned the poles may be expected to last sixteen years ; treated with preservatives they should last much longer. But there are good and bad strains of *E. globulus*. The best trees have large single flowers, vigorous foliage, and straight smooth-barked stems. Seed should be collected only from the best and most blight-resistant trees ; and in no case should the species be further planted where it has already failed. *E. globulus* has the merit of being able to grow and flourish in southern localities where the number of eucalypts available for cultivation is greatly reduced by climatic conditions.

(4.) *E. viminalis*.—The dead bark is usually deciduous from branches and stem, but may persist for a few feet near the ground ; leaves in juvenile stage sessile, lance-shaped, on adult trees rather narrow and long ; seed-cups up to $\frac{1}{4}$ in. in diameter, usually in threes ; mature wood pale, rather coarse in texture, strong, known to have lasted

twenty years in the ground. For New Zealand the species has the immense advantage of being adapted to a climate with cold winters. It is easily propagated and a great cropper. Splendid plantations of it may be seen in the Waikato, at Rotorua, in Marlborough, and in northern Canterbury. For poles it must be matured in close stands to prevent excess in diameter. A noble species closely similar to *E. viminalis*, and believed to be still more resistant to cold, has recently been made known to science under the name of *E. Dalrympleana*. Both are inland trees, and must be protected by screens of pines when planted near the sea. *E. Dalrympleana* should be introduced and tested in cold localities without delay.

(5.) *E. Gunnii.*—The dead bark is scaly and deciduous; leaves in juvenile stage round, sessile, on adult trees narrow, short; seed-cups in threes, long, narrow; mature wood pale, hard, said to be durable in the ground. The native home of the species is in the mountains of Tasmania. Away from the reach of frost and snow *E. Gunnii* remains small and feeble; at altitudes between 1,000 ft. and 2,000 ft. in the North Island, and on the lowlands of Southland, it becomes a vigorous and beautiful tree of medium dimensions. We cannot yet say that this tree will yield satisfactory poles; but the promise is fair and experiments well worth while.

WOOLLY-BUTTS.

The dead bark in this group is sub-fibrous or wholly non-fibrous; usually thick; on some species spongy, on others hard. It clings to the stem and in some cases also to the large branches.

(1.) *E. botryoides.*—The dead bark on old trees is very coarse and thick; leaves broad, shiny on upper surface; seed-cups $\frac{1}{4}$ in. to $\frac{1}{2}$ in. long, angular at base, sessile; mature wood red, coarse in texture, very durable in ground. In its native home—eastern Australia—it is a warm-country species, and at its best in localities not very remote from the sea. As an exotic in our North Island it is showing wonderful capacity for acclimatization. Near the coast and as far inland as Piako and Cambridge it has endured the frosts and attained a good pole-timber size in twenty-five to thirty-five years. It is a very beautiful tree and strongly resistant to insect enemies.

(2.) *E. longifolia.*—The dead bark on saplings is finely divided, on older trees coarse and thick; leaves on vigorous young trees long, on old trees medium; seed-cups in threes, up to $\frac{1}{2}$ in. long and $\frac{5}{8}$ in wide; mature wood dark red, very durable. The species comes from coastal regions in south-eastern Australia. From Auckland southward as far as Papakura it has grown to a pole-timber size in about thirty years.

(3.) *E. Macarthuri.*—The dead bark is thick and brittle; leaves in juvenile stage sessile and lance-shaped, on adult trees narrow; seed-cups very small, less than $\frac{1}{4}$ in. in diameter; mature wood pale, coarse in grain, liable to crack radially, very strong, long-lasting in ground. The native home of the species extends from eastern New South Wales westwards up the mountains. It is strongly resistant to frost and easily propagated. In the Waikato it has yielded very heavy crops and supplied many thousands of lasting fence-posts. It is a fair inference to expect that it will do well in Nelson, Marlborough, and

parts of northern Canterbury. For poles it must be planted close to check diameter growth, and near the sea it requires protection against the saline winds.

(4.) *E. acervula* (syn. *E. ovata*).—This species is not recommended for extensive planting, but where stands of it already exist they will supply strong poles of good medium durability. The species grows rapidly to pole-timber size up to altitudes of about 1,000 ft. all over the North Island.

IRONBARKS.

The dead bark in this group persists on stem and large branches; it is very firm, entirely non-fibrous, and on older specimens deeply furrowed. The ironbarks known to the timber trade are as follows:—

(1.) *E. crebra.*—The dead bark on young trees is pale, on older trees dark; leaves very narrow; seed-cups very small, about $\frac{1}{8}$ in. in diameter; mature wood dark with tinge of red, hard, strong, and very lasting.

(2.) *E. paniculata.*—Dead bark pale; leaves rather narrow, bright green; seed-cups small, under $\frac{1}{4}$ in. in diameter; mature wood pale, unsurpassed for strength and durability, much in demand for railway-sleepers, posts, and wire-poles.

(3.) *E. siderophloia.*—Dead bark at first flaky, later very hard, with deep furrows and wide ridges; leaves broad, especially in seedling and sapling stages; seed-cups up to $\frac{3}{8}$ in. in length; mature wood dull red, dense, strong, in first grade for wire-poles and other work in contact with the ground.

(4.) *E. sideroxylon.*—Dead bark very dark and hard; leaves rather narrow, leathery, dull green; seed-cups often over $\frac{3}{8}$ in. in depth, urn-shaped; mature wood red, very durable in any situation.

These four ironbarks are all indigenous to eastern Australia. All are warm-country trees, though *E. crebra* and *E. sideroxylon* extend their range westward over the cooler uplands. In New Zealand scattered specimens of *E. sideroxylon* have grown in forty years to a large pole-timber diameter in the North Island as far inland as Cambridge and as far south as Hawke's Bay; but their stems are neither very long nor quite straight. *E. paniculata*, favourably situated on the Auckland Isthmus, has grown to a small pole-timber size in thirty years; in other localities it has not done so well. *E. crebra* and *E. siderophloia* are represented by a few trees in genial situations, all still under pole-timber size. There is nothing yet in our New Zealand experience to warrant extensive planting of ironbarks; but there is good reason to make small experimental plantings of all the species in warm northern localities.

BOXES.

The name "box" came to be applied to the trees of this group because their bark somewhat resembled that of the European box-tree (*Buxus sempervirens*). The two most important eucalypts of the box group are *E. Bosistoana* and *E. hemiphloia*. They may be briefly described as follows:—

(1.) *E. Bosistoana.*—Dead bark short-fibred (or, as the botanists say, sub-fibrous), deciduous from branches, persistent on stem to a less or greater height; leaves in juvenile stage round or oval, on adult trees rather narrow; ripe seed-cups $\frac{1}{4}$ in. or more in diameter; mature wood

reddish-yellow, strong, and very durable in any situation. The species appears to be at its best on limestone formations in Gippsland, Victoria, where the trees present long branchless boles of the type required for carrying wires. *E. Bosistoana* has not yet been successively cultivated in New Zealand, but, reasoning from natural habitat, we might expect it to flourish on limestone country a little inland from our northern coasts.

(2.) *E. hemiphloia.*—Dead bark flaky, sub-fibrous; leaves very broad on seedlings and saplings, oval to very narrow on older trees; ripe seed-cups $\frac{5}{16}$ in. long by $\frac{3}{16}$ in. wide, or sometimes much smaller; mature wood pale, dense, strong, and very lasting. The species has a wide distribution on lowlands and uplands in eastern Australia. The trees as the traveller usually see them in Victoria and New South Wales are short, with spreading branches, and valuable only for fence-posts and fuel. In sheltered valleys they run up to a good pole-height. The best specimens known to the writer in New Zealand grew at "Trecarne," near Cambridge. They belonged to a small-fruited variety of the species. When first noted by the writer they were about thirty years old. In diameter they were then large enough for telegraph-poles, but some of them were deficient in length. *E. eugenioides* in the same plantation and of the same age more than equalled them in diameter and greatly exceeded them in length of clean stem. *E. Macarthuri*, also in the same plantation and of the same age, had already been yielding posts and poles of quite good durability. The boxes are thus in a similar position to the ironbarks. They must be still treated experimentally. *E. hemiphloia* varies greatly in merit under natural conditions in Australia. If we are to succeed with it as a cultivated timber-yielder in New Zealand competent steps must be taken to obtain supplies of seed from certified and approved parent trees where the species is at its best in cool parts of its native home. We have wasted much time and money in this country through breeding from inferior parent trees.

SPECIES IN ORDER OF RESISTANCE TO LOW TEMPERATURES.

It will further help the planter in selection of species for his particular district if our list is now presented in the order of resistance to low temperatures, as follows:—

Climatic Conditions.	Species.
Winters with severe and prolonged frosts and heavy falls of snow	*E. Gunnii*, *E. gigantea*, *E. Dalrympleana* (probably).
Winters with frequent severe frosts and occasional falls of snow	*E. viminalis*, *E. gigantea*.
Winters with many frosty nights usually followed by clear days	*E. globulus* (seaboard), *E. Macarthuri* (inland), *E. acervula*, *E. eugenioides*.
Winters with mild frosts usually followed by clear days	*E. eugenioides*, *E. saligna*, *E. botryoides*, *E. hemiphloia*, *E. Muelleriana*, *E. sideroxylon*, *E. laevopinea* (probably), *E. Bosistoana* (probably), *E. pilularis*.
Winters without or almost without frost, with many hot days in summer	*E. longifolia*, *E. corynocalyx*, *E. crebra*, *E. paniculata*, *E. siderophloia*.

In all cases where practicable information conveyed in printed articles should be supplemented by inspection of the planting-ground by some one who knows the species and has studied their behaviour in various localities.

GENERAL CONSIDERATIONS.

The demand generally will be for heavy crops in short rotation. Very few people will be found who will be content to plant slow-growing and light-cropping trees for the sake of greater durability in the timber. Choice will fall upon the best and most adapted of the rapid growers. We must look at the question in the light of what is happening in Australia. The natural forests of ironbark and box are heavily depleted. Regeneration is good in many localities, but insufficient for prospective requirements. Timbers of less durability are coming increasingly into use. Power Boards are having their poles treated with creosote and tar or other preservatives. In ten to twenty years' time poles imported from Australia may be no better than those we can abundantly produce in our own country. Preservative methods will have to be adopted here as elsewhere. Properly and efficiently treated, our own best poles may thus be expected to last quite as long as those we shall ultimately be able to obtain from our neighbours across the water, and when our home-grown poles decay the cheapest remedy will be renewal from adjacent plantations.

The importance of insect enemies as a factor in the selection of eucalypt species for New Zealand conditions is well recognized by the writer. It is proposed to treat this aspect of the subject more specifically in a later article.

PROLONGED GESTATION PERIOD IN COW.

A CASE of extraordinarily prolonged gestation in a cow has been reported by Mr. W. J. Price, of Hawera. The cow, an aged animal belonging to Mr. Price, was served on 14th November, 1923, and was milked right through the season, never returning to the bull. Mr. Price does not allow his bull to run with the cows until the winter months and after he has culled his herd. In the ordinary course this cow should have calved about 25th August, 1924. On 26th November of that year, states Mr. Price, he noticed her in trouble with calving, and yarded her for assistance. The calf—a heifer—was got away, but it died in the process. It had an extremely large frame and was very thin; it weighed 108 lb., the skin alone scaling 14 lb. The average weight of a calf at birth is about 70 lb. According to "Fleming's Obstetrics," the longest known period for which a cow has carried her calf is 353 days. Mr. Price's cow, it will be seen, exceeded this record by twenty-four days. The facts as given by Mr. Price are supported by his neighbour, Mr. H. Steffert.

—*E. E. Elphick, M.R.C.V.S., D.V.H., Live-stock Division.*

Noxious Weeds Orders.—Woolly nightshade has been declared by Bay of Islands County; broom, foxglove, and gorse by Waitomo County; and hemlock by Greytown Borough.

LOOSE SMUT OF WHEAT.

II. FIELD EXPERIMENTS ON SEED-DISINFECTION BY HOT WATER.

J. C. NEILL, Assistant Mycologist, Biological Laboratory, Wellington.

THE following article presents the results of field experiments for the 1924–25 season on the hot-water method for the control of loose smut in wheat (*Ustilago tritici* Jens.). These experiments are the direct continuation of the laboratory experiments the results of which appeared in the *Journal* for September, 1924.

METHOD EMPLOYED.

Small samples of seed wheat, taken from the same bulk sample of Major used in the previous work, were treated on 25th to 28th July, 1924, dried quickly in an air-current at 90°–100°,* and stored in paper packets in the laboratory. From each sample 300 seeds were taken for germination in the laboratory, and 400 seeds were sown in the field 2 in. apart, in rows each 5½ yards long, with 12 in. between rows. Between each four rows of treated seed two rows of untreated seed from the same bulk sample were sown to act as controls. The sowing took place at the Ashburton Experimental Farm on 9th to 12th September, the soil being in good tilth but very dry. No wheat had been grown on this portion of the farm for at least five years. The plots were covered with wire netting until sufficiently advanced to be safe from birds. A first count of germination was made on 14th to 17th October, the seedlings being then about 4 in. high, and the plants were finally pulled and counted on 6th to 16th January, 1925.

RESULTS OF EXPERIMENTS.

The results of the experiments are set out in the appended tabular statements. The main data and general conclusions may be summarized as follows:—

(1.) A three-minute dip, following a presoaking of five to six hours in water at a temperature of 63°, gave complete control of loose smut at 131° and 133°, though a single smutted plant appeared in the sample treated at 135°. With a presoaking of five to six hours in water maintained at 84° the three-minute dip gave complete control from 129° to 135°.

(2.) A five-minute dip, following a presoaking of five to six hours at 63°, gave complete control from 127° to 133°, but again a single smutted plant appeared at 135°. With a presoaking of five to six hours at 84° the five-minute dip gave complete control from 125° to 135°.

(3.) A ten-minute dip, following presoaking at 63°, gave complete control from 123° to 131°, and, with presoaking at 84°, from 123° to 131°.

* All temperatures are given in the Fahrenheit scale.

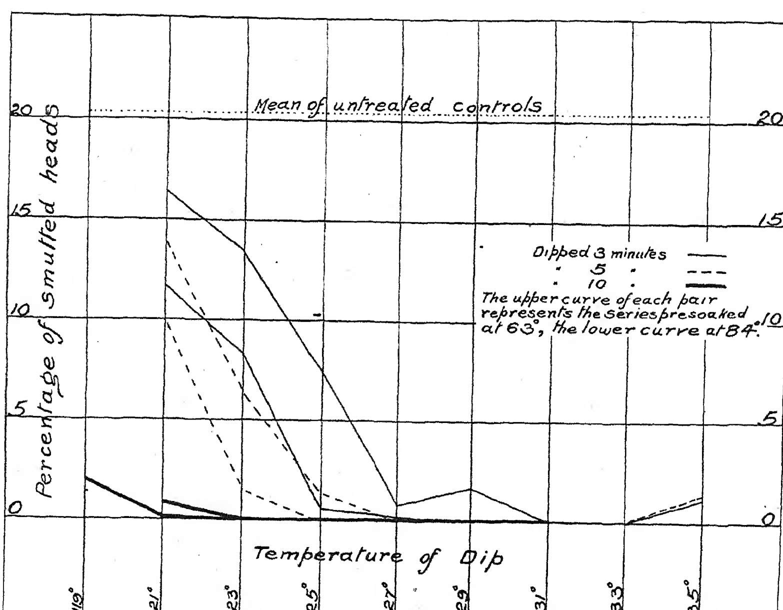
(4.) Without previous soaking only partial control was obtained by dipping for ten minutes up to 135°.

(5.) A soaking for twelve hours in water maintained at 104° gave complete control of the smut, with a loss of 8·2 per cent. of mature plants as compared with adjacent untreated controls.

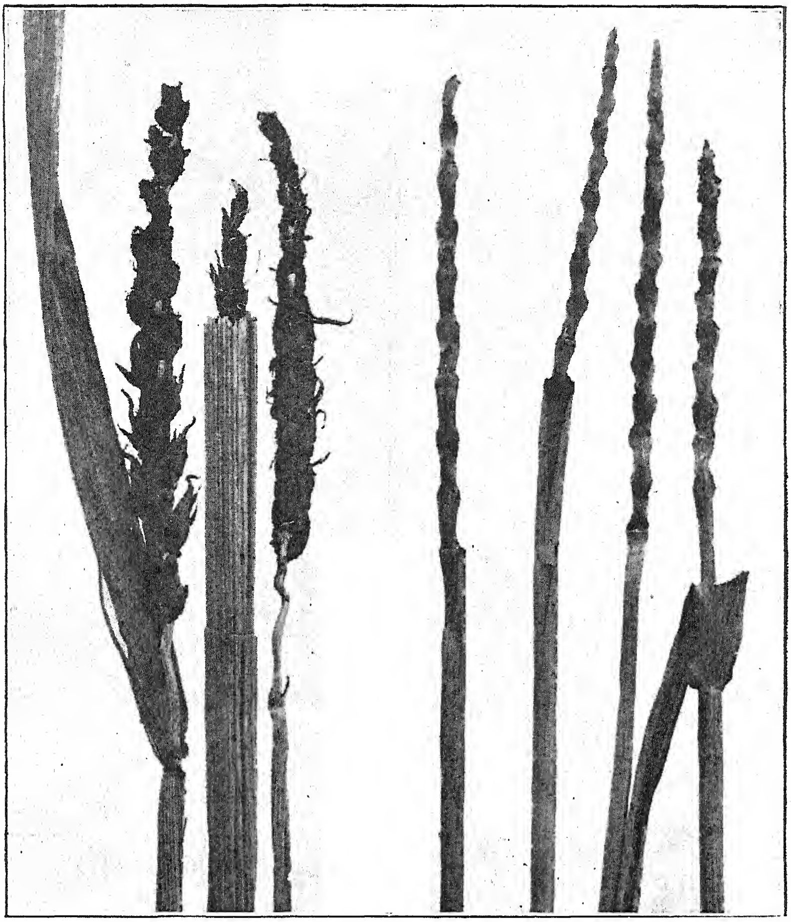
(6.) The effects of the treatments on germination of the seed are not so clearly defined as are the effects on the smut, owing, in all probability, to the generally low and irregular germination due to the dry period following sowing (see Table 7). A certain improvement in germination over controls is apparent at temperatures of dip below the critical point for complete killing of the smut, but above that point there is a loss in germination which increases with both the time and temperature of dip. All the experiments show, however, that it is possible to obtain, within practicable temperature limits, complete freedom from infection, with a loss in germination of less than 10 per cent.

(7.) The field germination of wheat is not materially affected by delaying sowing up to at least four months after treatment and drying.

(8.) The amount of loose smut present in the wheat stand appears to have no correlation with external conditions such as temperature, rainfall, or date of sowing, but to depend solely on the amount of infection present in the seed.



GRAPH SHOWING EFFECT ON LOOSE SMUT OF TEMPERATURE OF PRESOAK, AND TEMPERATURE AND DURATION OF DIP.



LOOSE SMUT OF WHEAT (USTILAGO TRITICI JENS.). NATURAL SIZE.

Left: At blossoming-time of wheat-plant. In centre stem shot-blade dissected away to show inflorescence converted to mass of smut-spores before emergence.

Right: Same at harvest-time. Smut-spores all blown away, bare rachis alone remaining.

(Material from Ashburton Experimental Farm.)

[*Photos by H. Drake.*

Table 1. Seed Wheat dipped Three Minutes.

Temperature of Dip.	Percentage Germination.				Plants.			Heads.			Sound Heads harvested per 100 Seeds sown.
	Laboratory.	Field.									
		First Count.	Mature Plants.	Gain or Loss over Adjacent Controls.	Total.	Smutted.	Percentage Smutted.	Total.	Smutted.	Percentage smutted.	
(*a.*) Presoaked Five to Six Hours at 63°.											
Control	98·5	47·5	47·5	..	95	25	26·4	562	122	21·7	220
121° ..	97·7	48·5	45·2	+2·5	181	37	20·4	1,034	170	16·4	216
Control	98·5	44·5	38·0	..	76	18	23·7	471	106	22·5	182
123° ..	96·7	44·5	32·0	−5·5	128	33	25·8	1,017	137	13·4	220
Control	98·5	40·0	37·0	..	74	16	21·6	493	83	16·8	205
125° ..	99·3	39·7	35·7	+0·2	143	19	13·3	807	60	7·4	187
Control	98·5	37·0	34·0	..	68	15	22·1	518	94	18·2	212
127° ..	95·3	38·7	35·2	+0·7	141	2	1·4	978	8	0·8	242
Control	98·5	38·0	35·0	..	70	17	24·3	462	86	18·7	188
129° ..	93·7	36·5	34·0	−4·2	136	3	2·2	952	16	1·7	234
Control	98·5	43·5	41·5	..	83	27	32·5	545	156	28·7	194
131° ..	95·0	42·0	38·0	−1·5	152	0	0	933	0	0	233
Control	98·5	39·5	37·5	..	75	17	22·7	407	78	19·2	164
133° ..	94·7	36·7	34·0	−2·5	136	0	0	794	0	0	198
Control	98·5	37·0	35·5	..	71	13	18·4	402	67	16·7	167
135° ..	90·0	36·2	34·0	−2·7	136	1	0·7	847	10	1·2	209
Control	98·5	38·0	38·0	..	76	18	23·7	469	97	20·6	186
(*b.*) Presoaked Five to Six Hours at 84°.											
Control	98·5	42·0	37·0	..	74	18	24·3	351	66	18·8	142
121° ..	97·3	45·7	39·5	+3·5	158	25	15·8	694	81	11·7	153
Control	98·5	39·0	35·0	..	70	20	28·6	295	62	21·0	116
123° ..	98·7	44·5	40·5	+1·3	162	16	9·9	762	63	8·3	175
Control	98·5	46·5	43·5	..	87	9	10·3	394	34	8·6	180
125° ..	99·3	42·0	36·2	−4·5	145	1	0·7	696	4	0·6	173
Control	98·5	45·5	38·0	..	76	17	22·4	390	63	16·2	163
127° ..	98·0	46·2	43·2	+2·7	173	1	0·6	807	2	0·2	201
Control	98·5	44·5	41·0	..	82	22	26·8	382	95	24·9	143
129° ..	96·7	44·7	41·7	−0·3	167	0	0	815	0	0	204
Control	98·5	45·5	43·0	..	86	24	28·0	471	96	20·4	187
131° ..	97·7	45·6	40·7	−4·8	163	0	0	771	0	0	193
Control	98·5	51·0	48·0	..	96	17	17·7	441	58	13·2	191
133° ..	95·3	39·5	38·2	−9·0	153	0	0	807	0	0	201
Control	98·5	47·0	46·5	..	93	18	19·4	481	72	15·0	204
135° ..	93·0	45·0	42·0	−1·2	168	0	0	909	0	0	227
Control	98·5	41·0	40·0	..	80	14	17·5	436	56	12·8	190

Table 2. Seed dipped Five Minutes.

Temperature of Dip.	Percentage Germination.				Plants.			Heads.			Sound Heads harvested per 100 Seeds sown.
	Laboratory.	Field.									
		First Count.	Mature Plants.	Gain or Loss over Adjacent Controls.	Total.	Smutted.	Percentage Smutted.	Total.	Smutted.	Percentage smutted.	
(a.) Presoaked Five to Six Hours at 63°.											
Control	98·5	38·0	38·0	..	76	18	23·7	469	97	20·6	186
121° ..	96·3	36·5	34·2	**−0·3**	137	26	**19·1**	760	106	**13·9**	**163**
Control	98·5	31·5	31·0	..	62	19	30·7	393	103	26·3	145
123° ..	97·3	39·7	35·0	**−3·7**	140	15	**10·7**	859	54	**6·3**	**201**
Control	98·5	50·5	46·5	..	93	27	29·0	540	160	29·7	190
125° ..	97·3	46·5	40·2	**−2·5**	161	6	**3·7**	980	13	**1·4**	**242**
Control	98·5	40·5	39·0	..	78	18	23·1	419	82	19·6	168
127° ..	97·0	34·0	30·2	**−8·8**	121	0	**0**	694	0	**0**	**173**
Control	98·5	41·5	39·0	..	78	23	29·5	429	114	26·5	157
129° ..	93·3	41·0	37·7	**−3·9**	151	0	**0**	881	0	**0**	**220**
Control	98·5	47·5	44·2	..	89	22	24·7	476	124	26·0	176
131° ..	92·3	39·7	37·0	**−8·3**	148	0	**0**	702	0	**0**	**175**
Control	98·5	50·0	46·5	..	93	19	20·5	406	75	18·5	165
133° ..	85·3	44·2	42·2	**−10·3**	169	0	**0**	686	0	**0**	**171**
Control	98·5	64·5	58·5	..	117	30	25·6	532	125	23·5	203
135° ..	50·7	10·2	10·7	**−33·8**	43	1	**2·3**	213	3	**1·4**	**52**
Control	98·5	35·0	30·5	..	61	11	18·0	326	35	10·8	145
(b.) Presoaked Five to Six Hours at 84°.											
Control	98·5	41·0	40·0	..	80	14	17·5	436	56	12·8	190
121° ..	96·3	41·0	38·5	**+0·3**	154	20	**13·0**	851	84	**9·9**	**192**
Control	98·5	39·5	36·5	..	73	17	23·3	424	87	20·5	168
123° ..	95·7	43·2	40·0	**+4·3**	160	5	**3·1**	869	13	**1·5**	**214**
Control	98·5	39·0	35·0	..	70	18	25·7	397	83	20·8	157
125° ..	98·0	33·0	30·5	**−3·0**	122	0	**0**	737	0	**0**	**184**
Control	98·5	36·0	32·0	..	64	12	18·8	366	47	12·9	159
127° ..	98·3	44·2	40·7	**−7·0**	163	0	**0**	800	0	**0**	**200**
Control	98·5	66·0	63·5	..	127	25	19·7	646	107	16·3	269
129° ..	95·3	49·2	43·5	**−13·0**	174	0	**0**	889	0	**0**	**222**
Control	98·5	56·5	49·5	..	99	22	22·2	548	117	21·4	215
131° ..	95·0	47·7	42·2	**−10·3**	169	0	**0**	778	0	**0**	**194**
Control	98·5	56·0	55·5	..	111	26	23·4	543	104	19·2	219
133° ..	87·7	31·2	29·0	**−19·5**	116	0	**0**	601	0	**0**	**150**
Control	98·5	43·0	41·5	..	83	25	30·1	403	109	27·2	147
135° ..	68·0	11·2	10·7	**−28·8**	43	0	**0**	267	0	**0**	**67**
Control	98·5	41·5	37·5	..	75	17	22·7	422	85	20·2	168

Table 3. Seed dipped Ten Minutes.

Temperature of Dip.	Percentage Germination.				Plants.			Heads.			Sound Heads harvested per 100 Seeds sown.
	Laboratory.	Field.									
		First Count.	Mature Plants.	Gain or Loss over Adjacent Controls.	Total.	Smutted.	Percentage Smutted.	Total.	Smutted.	Percentage smutted.	
				(a.) Presoaked Five to Six Hours at 63°.							
Control	98·5	35·0	30·5	..	61	11	18·0	326	35	10·8	145
121° ..	98·0	33·2	26·0	**−4·2**	104	2	**1·9**	488	4	**0·8**	**121**
Control	98·5	34·0	30·0	..	60	17	28·3	252	55	21·8	98
123° ..	97·7	32·5	29·2	**−3·3**	117	0	**0**	516	0	**0**	**129**
Control	98·5	45·5	35·0	..	70	19	27·1	318	69	21·7	124
125° ..	95·7	35·2	30·0	**−7·2**	120	0	**0**	638	0	**0**	**159**
Control	98·5	44·0	39·5	..	79	23	29·1	384	90	23·5	147
127° ..	94·3	41·5	35·5	**−5·0**	142	0	**0**	654	0	**0**	**163**
Control	98·5	43·0	41·5	..	83	18	21·7	392	69	17·6	161
129° ..	93·7	35·2	33·2	**−12·0**	133	0	**0**	573	0	**0**	**143**
Control	98·5	52·0	49·0	..	98	26	26·6	424	86	20·3	169
131° ..	87·7	42·0	37·5	**−5·5**	150	0	**0**	637	0	**0**	**159**
Control	98·5	42·0	37·0	..	74	18	24·3	351	66	18·8	142
				(b.) Presoaked Five to Six Hours at 84°.							
Control	98·5	41·5	37·5	..	75	17	22·7	422	85	20·2	168
119° ..	98·0	40·0	35·0	**−5·7**	140	5	**3·6**	801	15	**1·9**	**196**
Control	98·5	47·5	44·0	..	88	25	28·5	463	126	27·2	168
121° ..	96·7	57·0	53·5	**+1·3**	214	1	**0·5**	1,038	1	**0·1**	**259**
Control	98·5	65·5	60·5	..	121	31	25·6	567	136	24·0	215
123° ..	96·0	62·7	57·7	**0**	231	0	**0**	1,098	0	**0**	**274**
Control	98·5	58·0	55·0	..	110	25	22·8	555	106	19·1	224
125° ..	98·3	49·5	44·2	**−6·5**	177	0	**0**	845	0	**0**	**211**
Control	98·5	49·5	46·5	..	93	24	25·8	487	117	24·0	185
127° ..	97·0	48·5	43·7	**−7·5**	175	0	**0**	848	0	**0**	**212**
Control	98·5	58·0	56·0	..	112	34	30·4	567	151	26·6	208
129° ..	94·3	41·0	37·2	**−16·3**	149	0	**0**	781	0	**0**	**195**
Control	98·5	55·5	51·0	..	102	27	26·5	571	129	22·5	221
131° ..	74·3	26·0	24·7	**−24·5**	99	0	**0**	550	0	**0**	**137**
Control	98·5	55·5	47·5	..	95	16	16·9	469	77	16·4	196

Table 4. Seed dipped Ten Minutes. No Presoak.

Temperature of Dip.	Percentage Germination.				Plants.			Heads.			Sound Heads harvested per 100 Seeds sown.
	Laboratory.	Field.			Total.	Smutted.	Percentage Smutted.	Total.	Smutted.	Percentage smutted.	
		First Count.	Mature Plants.	Gain or Loss over Adjacent Controls.							
Control	98·5	34·0	29·0	..	58	12	20·7	498	76	15·3	211
123° ..	98·3	34·5	33·2	**+4·0**	133	29	**21·8**	1,115	188	**16·9**	**231**
Control	98·5	32·5	29·5	..	59	21	35·6	572	157	27·4	207
127° ..	96·7	38·5	36·7	**+6·7**	147	31	**21·1**	1,236	194	**15·7**	**260**
Control	98·5	30·5	30·5	..	61	16	26·3	526	135	25·6	195
131° ..	95·3	30·2	28·7	**−3·3**	115	22	**19·1**	1,019	162	**15·9**	**214**
Control	98·5	36·0	33·5	..	67	10	14·9	513	60	11·7	226
133° ..	96·0	38·0	37·0	**−0·2**	148	20	**13·5**	1,010	112	**11·1**	**224**
Control	98·5	42·0	41·0	..	82	21	25·6	512	122	23·6	195
135° ..	67·3	23·5	21·5	**−22·7**	86	14	**16·3**	617	99	**16·0**	**129**
Control	98·5	47·5	47·5	..	95	25	26·4	562	122	21·7	220

Table 5. Test of Deterioration of Seed after Storage (treated 8th May, sown 11th September): Presoaked Six Hours at 63°; dipped Ten Minutes at 127°.

Temperature of Dip.	Percentage Germination.				Plants.			Heads.			Sound Heads harvested per 100 Seeds sown.
	Laboratory.	Field.			Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	
		First Count.	Mature Plants.	Loss compared with Controls.							
Control	98·5	47·0	43·5	..	87	23	26·5	560	120	21·4	220
Treated	94·0	40·2	35·2	**−10·0**	141	0	**0**	947	0	**0**	**237**
Control	98·5	47·5	47·0	..	94	20	21·3	522	98	18·8	212

Table 6. Seed soaked for Twelve Hours at 104°.

Control	98·5	55·5	47·5	..	95	16	16·9	469	77	16·4	196
Treated	95·7	48·0	41·5	**−8·2**	166	0	**0**	797	0	**0**	**199**
Control	98·5	55·0	52·0	..	104	33	31·7	479	139	29·3	168

Table 7. Incidence of Loose Smut in relation to Date of Sowing.

Date of Sowing.	Percentage of Plants matured.	Plants.			Heads.			Ashburton Meteorological Records.		
		Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	Week ending.	Mean Temperature.	Total Rainfall.
1924.								1924.		Inches.
								10 May ..	49·1	0·62
								17 ,, ..	50·7	0·04
17 May ..	90·0	180	33	18·3	1038	126	12·1	24 ,, ..	47·3	0·40
24 ,, ..	79·5	159	43	27·0	970	153	15·8	31 ,, ..	47·5	0·84
31 ,, ..	74·5	149	30	20·1	862	112	13·0	7 June ..	41·6	0·69
9 June ..	76·0	152	37	24·4	862	140	16·3	14 ,, ..	45·0	0·61
14 ,, ..	59·0	118	27	23·0	681	111	16·3	21 ,, ..	39·9	0·24
21 ,, ..	35·0	70	17	24·3	508	92	18·1	28 ,, ..	40·5	0·31
28 ,, ..	28·0	56	8	14·3	454	41	9·0	5 July ..	42·1	0·06
5 July ..	33·0	66	18	27·2	462	85	18·5	12 ,, ..	41·9	0·06
12 ,, ..	53·5	107	26	24·3	711	104	14·6	19 ,, ..	43·9	0·00
19 ,, ..	50·5	101	22	21·8	649	103	15·9	26 ,, ..	37·9	0·24
26 ,, ..	68·5	137	32	23·4	748	130	17·4	2 Aug. ..	44·9	0·25
2 Aug. ..	64·5	129	30	23·2	707	127	17·8	9 ,, ..	41·0	0·37
9 ,, ..	57·0	114	25	22·0	697	140	20·0	16 ,, ..	46·1	0·33
16 ,, * ..	44·2	177	37	21·0	784	152	19·4	23 ,, ..	42·9	0·09
23 ,, * ..	46·7	187	57	30·5	805	194	24·1	30 ,, ..	48·5	0·01
30 ,, ..	53·5	107	25	23·4	648	116	17·0	6 Sept. ..	46·7	0·21
9 Sept. ..	48·0	96	25	26·0	594	114	19·2	13 ,, ..	47·6	0·00
13 ,, ..	35·0	70	19	27·2	315	85	27·0	20 ,, ..	54·3	0·00
20 ,, ..	88·0	176	36	20·5	674	121	17·9	27 ,, ..	53·3	1·04
27 ,, ..	89·0	178	49	27·5	608	152	25·0	4 Oct. ..	56·8	0·02
4 Oct. ..	92·5	185	43	23·3	635	116	18·3	11 ,, ..	53·0	0·62
General Mean of Controls in Tables 1–6.										
9–12 Sept.	42·0	..	..	24·2	..	..	20·4	..	..	..

* In these two sowings the seeds were planted 1 in. apart, 400 seeds being sown instead of 200 as in the other sowings of the series.

The meteorological records were kindly supplied by Mr. H. P. Clayton, Curator of the Ashburton Botanical Gardens and Meteorological Station. The records were taken two miles from the site of the experiments. The figures given under "Mean Temperature" are the arithmetical mean for the week of the daily maxima and minima.

The writer wishes to acknowledge gratefully the help rendered in this work by Mr. J. G. McKay, Overseer of the Ashburton Experimental Farm, who carried out the weekly sowings recorded in Table 7, and whose practical assistance has proved invaluable throughout the whole of the experiments. The writer's thanks are also due to Mr. N. R. Foy, Seed Analyst, and his assistants, who carried out the laboratory germinations here recorded; and to Mr. F. E. Ward, Instructor in Agriculture, for co-operation in providing facilities for the work.

IRON-HUNGER IN RUMINANT STOCK.*

THE SEASON'S WORK AT MAMAKU DEMONSTRATION FARM.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Agriculture Department.

In summarizing the work of the Mamaku Demonstration Farm during the season now closing one has to record an unfortunate visitation of mammitis, which is liable to attack any milking-herd. This has to a considerable extent interfered with the scheme of medicinal and other treatment which had been decided upon. Data of a most interesting and valuable character have been acquired, however, in spite of the outbreak. In the following pages is set down the history of the cows belonging to the experimental herd and their offspring. The April, 1924, *Journal* should be consulted for previous details of their history.

The salient features of this record are a complete confirmation of the curative properties of iron and ammonium citrate, the preventive effect of the concentrated foodstuff molasses, and the beneficial effect of a winter ration of hay made from grass grown on land cultivated and top-dressed, together with swede turnips, coincident with a grazing on pastures top-dressed with phosphates. The novel features of this season's work are the successful use of the double citrate of iron and ammonium in conjunction with hay. The method of using this drug, which may prove to be a most valuable one in farming practice, is the idea of the Farm Overseer, Mr R. A. Jackson. He first suggested the method of mixing the drug with the hay when it was being built into the stack. Feeding this treated hay has given excellent results on the few animals upon which it has been tried. The idea commends itself as a practicable one in the administration of the curative medicine, and surpasses the other methods tried—*i.e.*, by drenches and by licks—in being automatically taken by the animal, while at the same time being only consumed in small repeated doses. This improved method removes the two great objections to the use of drenches and licks which the hardworking farmer will urge — the time taken to give drenches, and the difficulty in controlling the amount given automatically as licks. With drenches the labour of dosing a herd of cows is great. With sugar-iron bricks the animals are so greedy for the stuff that there is difficulty in controlling the consumption, and calves are apparently stunted in their growth by an overdose (see Fig. 3). There is the additional difficulty that such licks in a moist climate like that of Mamaku absorb water very rapidly and soon deteriorate. The cost of the sugar is an additional item of expense. Salt-iron bricks for some reason are not efficacious. When, on the other hand, the iron compound, either as scales or in solution, is sprinkled on the hay, the iron is fed out to the stock suitably diluted by the hay, and no animal can consume too much.

* A very general response having been made to the suggestion that the misleading term "bush sickness" should be abandoned in favour of one more in keeping with the known facts, the term "iron starvation" or "iron-hunger" will in future be used by the present writer to denote what is locally known as "bush sickness" or "the skinnies."

This season Mr. Jackson has made some 20 tons of excellent hay treated in the following manner: The iron and ammonium citrate (23 lb.) was dissolved in 8 gallons of water; when all dissolved 45 lb. of sugar was mixed in, and the whole was then mixed with 4 gallons of molasses. The liquid was sprayed on to the layers of hay by means of a Vermorel knapsack sprayer, and was sufficient for 15 tons of hay. The solution is absorbed and dries at once on the freshly made hay. Another method which is being tried on a smaller scale consists in merely sprinkling the solid scales of the iron compound on to the layers of hay without the addition of water, sugar, or molasses.

The writer considers that the outlook for the future of these iron-hungry lands was never more promising. To succeed in combating the trouble in a practicable manner at Mamaku, where the climate is severe in winter, argues for a much more favourable result in districts which are situated at lower elevations under less rigorous conditions. In this connection the Department would welcome assistance from farmers in demonstrating the effective use of iron ammonium citrate as a preventive and cure of iron-hunger, and for this purpose will supply at cost price (3s. 9d. per pound, postage free) a limited quantity of the drug. An amount of 1 lb. will be sufficient to drench for two months one cow, which should then, if the trouble is not too advanced, show an improvement.

TREATMENT OF COWS OF THE DAIRY HERD.

It was resolved that as certain cows which had been on the farm for two or three years (see April, 1924, *Journal*) were due to calve in winter — a most trying season at Mamaku — they should be given exceptional treatment in the shape of a change to the Tirau paddock. The cows thus treated were "Te Kuiti" (who was in good condition when she went to Tirau on 1st February, 1924), "Roanie" (also in good condition when she went there on 21st February), and "Ginger" (in very good condition when she went on the same date).

"*Te Kuiti*" came back from Tirau in first-rate condition on 8th May. She did well, and was springing on 30th June. She was then getting hay and turnips, and calved on 11th July; the strong, healthy bull calf was destroyed. At 31st July she was giving 18 lb. milk daily; condition good: 31st August, 22 lb. milk, being in good condition and getting hay and turnips: 7th September, 25 lb. milk; went to bull in good condition: 30th September, 25 lb.: 1st November, 27 lb.: 1st December, 22 lb.: 1st January, 1925, 17 lb.: 23rd February, 17 lb. milk; condition good.

"*Roanie*" came back from Tirau on 8th May, and on 13th gave birth to a dead calf, but was in good condition herself, milking well, and giving 20 lb. milk daily; 9th June, still giving 20 lb. and in good condition, getting hay and turnips, also 1 lb. molasses in a little chaff once a day; 30th June, still giving 20 lb., and treatment being continued; 1st August, molasses treatment discontinued, condition being good; 31st August, giving 2½ gallons milk, still getting hay and turnips; 6th September, all turnips finished, condition good, giving 26 lb.; 1st October, 23 lb.; 1st December, 20 lb.; 1st January, 16 lb., her condition being good throughout; at 23rd February was a little dull about the eye and hair rough, but animal in good condition; 12 lb. milk daily.

"*Ginger*" came back from Tirau looking well, but must have slipped her calf there. After getting hay and turnips she was sold for beef on 25th September as she was not in calf.

"Brindle" and "Cherry," two cows, the former of which never had any exceptional treatment except molasses, are an outstanding

testimonial to its efficacy in keeping both themselves and their offspring healthy. (The ash of molasses contains up to 7 per cent. of iron oxide.) "Maud" had the advantage of a recent change to Tirau, but is also a testimonial to molasses. The previous records of these cows can be seen in the April, 1924, *Journal*. "Cherry" and "Maud" have previously gone "sick," but "Brindle," whose sole treatment has been molasses, has never been sick. Like the other two, she lost her first calf, but subsequently raised three healthy calves in succession, all now alive and doing well at the farm. The success of these cows and their offspring can only be attributed to the treatment.

"*Brindle*."—At 10th May, 1924, this cow was milked once a day—condition being good—up to 9th June, when she was dry, and was running on swedes with a good run-off; on 30th July she was given hay with the swedes; on 7th September the swedes were finished, and the treatment of giving 1½ lb. of molasses once a day was commenced. The treatment was discontinued on 30th October, the condition

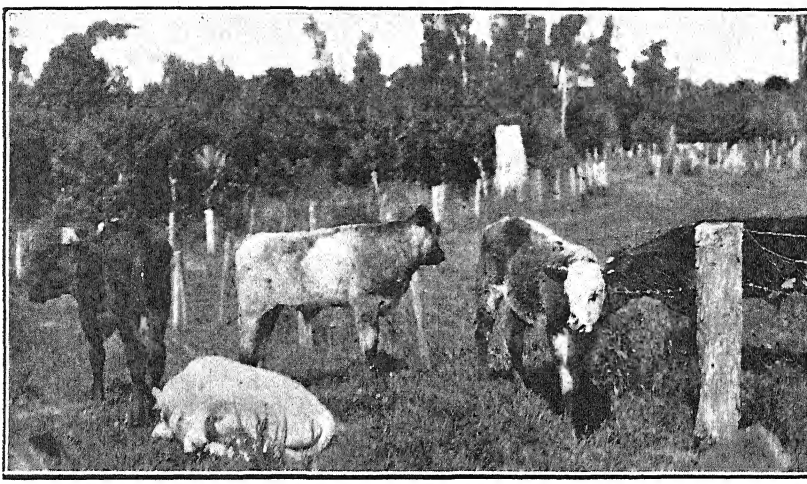


FIG. 1. SOME OF THE CURRENT SEASON'S CALVES AT MAMAKU DEMONSTRATION FARM (BORN IN 1924).

From left to right: Maggie's, Lily's, Brindle's, Cherry's, Molly's.

of the cow being good all through the winter. She calved 4th November—a roan bull calf, strong and healthy. Cow in first-rate condition, and giving 56 lb. milk daily till 1st December. At 1st January, 1925, she was giving 44 lb. milk, her condition being first rate; on 23rd February, condition first rate, 40 lb. milk.

"*Cherry*" was giving on 3rd March, 1924, 30 lb. milk; 10th April, 24 lb., test 3·4 per cent.; 30th April, 18 lb. On 30th May was in good condition and milking once a day. On 1st June commenced to receive 1 lb. molasses once a day in local chaff; weight of milk, 10 lb.; feeding on hay and turnips. She was dry on 1st July, and the molasses were discontinued; condition good. On 31st August she was still on swedes and getting a little hay with a good run-off. On 7th September the swedes were finished, and the molasses treatment was recommenced as on 5th June. On 5th October she calved, the calf being strong and healthy and the cow in good condition. On 31st October was giving 43 lb. milk and was in good condition. On 16th November the molasses treatment was discontinued. She has continued in good condition, and was giving at 1st December 42 lb.; 1st January, 1925, 40 lb.; 23rd February, 35 lb. milk; condition good.

"*Maud,*" on 10th April, 1924, was giving 9 lb. of milk, testing 3 per cent., once a day, and was in good condition. She was dry on 10th May, and was put on soft turnips on 16th May. She was turned on to the swedes on 9th June, but hay was not given until 7th September, when all the roots were finished, the cow being in good condition and springing. She calved on 10th October, the calf being strong and healthy, but as the cow was affected with mammitis she was turned out with her calf. Both were well on 1st January, 1925.

"*Polly.*"—This cow had been brought back to health by the iron-ammonium-citrate treatment last year, giving 19 lb. milk, testing 3·6, on 10th April, 1924. She was dry on 16th May, 1924, and not in calf. She was grazed on swedes and given hay and a good run-off in June, July, and August. She was in first-rate condition at 31st August, and was sold for beef on 25th September.

"*Daisy*" was a cow which in the past had no special treatment, but a good supply of hay and turnips. On 10th April, 1924, she was giving 19 lb. milk, testing 3 per cent., and was in good condition. At 30th April she was giving 10 lb.; on 10th May she was in good condition and giving 7 lb.; on 30th May, 4 lb. Badly affected with mammitis, she was turned on to soft turnips, and on to swedes on 9th June. Thence till 31st August she had swedes with hay, and her condition was first rate. She was springing on 1st October and calved on 30th November, the calf strong and healthy, but the cow no good to milk owing to mammitis. At 1st December the cow was looking well, but the calf was not doing well, not getting enough milk. This was also the condition of things at 1st January, 1925. At 23rd February cow was fit for beef; calf destroyed, as not enough milk from cow.

"*Lily*" had in the past failed to be kept healthy on turnips and had lost her first calf, and had to be sent to Tirau, so rapid was her decline through bush sickness after calving. After her return the iron treatment was given and a healthy calf was born. In April, 1924, she was giving 26 lb. milk, testing 3·8 per cent., and her condition was good. At 30th May, milking once daily, 12 lb. milk; 30th June, 7 lb. milk, on hay and turnips; condition good. On 1st August the iron treatment was commenced; getting 2½ oz. home-made iron ammonium citrate made from commercial lime-juice, in local chaff, twice a day, the cow being dry. On 7th September the turnips were all finished. The iron treatment was terminated on 1st October, her condition being first rate. Calved on 14th October, the calf being strong and healthy and the cow in first-rate condition. On 1st December was giving 43 lb. milk daily, and on 1st January, 1925, 38 lb., condition continuing first rate; 23rd February, condition first rate, 34 lb. milk.

"*Darkie.*"—On 10th May, 1924, commenced to milk this cow once daily; 30th May, condition good, milking once daily; 1st June, commenced on hay and turnips, and getting citrate sugar brick; 30th June, milking once daily, and on same feed and treatment. Cow did not take the brick well, so it was given crushed up with chaff, which she took well. On 31st July finished giving iron sugar brick, cow not taking it well. (The composition of the sugar brick was 8 lb. raw sugar and 4 oz. or 8 oz. iron ammonium citrate scales.) Cow then on swedes, condition good. On 5th August she seemed to be getting abnormal in size, although chewing cud and eating well. On 17th August she died of dropsy of the womb. A *post-mortem* examination showed seven-months-old twins and 15 gallons of fluid.

Cows which arrived at Farm in 1923.

The cows which arrived at the farm in 1923 will now be discussed.

"*Spot*" (arrived July, 1923), a six-year-old Shorthorn, white and yellow, was in good condition on 20th May, 1924, and was getting soft turnips and grass. From 7th July to 6th September she grazed on turnips and got hay. The calf was born dead on 22nd September, but the cow was in good condition, though bad with mammitis, and it not being possible to milk her she was turned out to fatten. At 1st November her condition was not good, and on 10th December she was obviously going bush-sick. On 15th December a new method of treatment, the subcutaneous administration of sodium iron citrate, was commenced. Treatment was finished on 7th January, 1925, but no improvement except a brighter eye was noticeable after twenty-five days' treatment. On 1st February, going bush-sick quickly; commenced to drench twice daily with home-made iron ammonium citrate. On 23rd February, improvement marked; treatment continued.

"*Mona*," a Shorthorn six-year-old roan, arrived 2nd July, 1923, and calved 5th August. At 9th June, 1924, she was getting swedes and hay, and milking once daily. At 30th June she was dry and in good condition. She was given 2½ bricks during three weeks (iron ammonium citrate and sugar). She was turned into swede-paddock on 31st July, and by 6th September they were all finished. Cow was then in first-rate condition and treatment with sugar brick was recommenced. On 17th November she calved. On 1st December was giving 42 lb. milk, and on 1st January, 1925, 40 lb., having been in first-rate condition since 5th November; 23rd February, condition first rate, and giving 40 lb. milk.

"*Buttercup*," a six-year-old Shorthorn, arrived 2nd July, 1923, and calved 7th August. On 10th May, 1924, she was dry and in fair condition, and grazing on No. 1 paddock, soft turnips and grass. On 9th June she was transferred from No. 1 to the first break of swedes. On 30th June, when still on the swedes, she had gone back in condition, and on 5th July was given molasses in local chaff, a treatment to which she did not take. On 31st July, as she was evidently not a suitable subject for the molasses treatment, she was given the drenching treatment with the home-made iron ammonium citrate, 2½ fl. oz. twice a day. On 31st August a little improvement was noticeable; the cow was still getting hay and turnips. On 3rd September cow calved a little prematurely; calf dead; was poorly nourished. On 8th September cow just a little better, but weak; drenching continued. On 30th September decided improvement; milking better; weight of milk, 24 lb.; drenching continued. On 1st November drenching continued; improvement in milk-yield, 44 lb. On 15th November still improving; drenching discontinued. In December was in good condition, quite recovered; weight of milk, 44 lb. On 1st January, 1925, condition good; milk, 38 lb. On 23rd February, condition good; 30 lb. milk.

"*Maggie*," a light-roan Shorthorn six-year-old, arrived on 2nd July, 1923, and calved 8th August. On 30th May, 1924, was grazing in No. 1 paddock; if anything, better in condition. On 5th June was put into No. 4 paddock and given hay containing commercial iron ammonium citrate scales and molasses put into stack at time of building, and was still getting turnips daily. On 30th June her condition was fair, with same treatment continued. On 31st July treatment continued; condition, if anything, better. On 31st August continuing to improve, condition good, treatment continued. On 30th September treated hay all finished. On 20th September cow calved; calf strong and healthy; cow in first-rate condition. Calf was put on to "Molly," and subsequently fed "on the bucket." On 5th October weight of milk 45 lb.; 5th November, 44 lb.; cow in good condition. On 1st December, 40 lb. milk; cow in good condition. On 1st January, 1925, milk 31 lb.; cow in good condition. On 23rd February condition fair; 29 lb. milk.

"*Peggy*," a light-roan Shorthorn six-year-old, arrived on 2nd July, 1923; calved 9th August. On 10th May, 1924, she was dry; grazing on No. 1 paddock on soft turnips and young grass; condition good. On 30th May still on soft turnips. On 9th June put on to swede turnips with no hay. On 30th June still grazing on turnips; condition fair. On 31st July still on swedes and getting hay; condition improved. On 31st August continued to run on swedes with a little hay and a good run-off; condition good. On 6th September finished all swedes. 30th September, in first-rate condition. 5th October calved; calf strong and healthy. 5th November, cow in good condition; milk, 35 lb. 1st December, weight of milk 34 lb. 1st January, cow losing condition, but as she was giving a high-testing milk this was perhaps natural; milk, 31 lb. 23rd February, condition good; 23 lb. milk.

"*Fanny*," a roan Shorthorn six-year-old, arrived 2nd July, 1923; calved 10th August. On 10th May, 1924, grazing in No. 1 paddock on soft turnips and young grass; condition good. 9th June, put on to swedes but no hay, as she had a good run-off; remained on swedes to 31st August. 7th September, finished swedes. 26th September calved, but no good as milker, being affected with mammitis; calf dead at birth; put two calves on to cow ("Jean's" and "Maggie's"); did not take to the calves, which had to be killed; milking the cow to dry her off. 5th November, milking much better—35 lb.—and cow in good condition. 1st December, condition still good; 33 lb. milk. 1st January, 1925, condition good; 26 lb. milk. 23rd February, condition good; 23 lb. milk.

"*Jean*," a red Shorthorn six-year-old, arrived 2nd July, 1923, and calved on 10th August. On 10th May, 1924, was dry and grazing in No. 1 paddock on soft turnips and young grass, where she continued in good condition until 9th June, when she was put into the swede-paddock. Continued with this treatment until 31st August, when the swedes were finished. Calved on 25th September, the calf being strong and healthy and the cow in first-rate condition. On 5th October was giving 35 lb. milk. On 1st November she was losing condition and not milking so well as in the previous year; milk, 27 lb. 1st December, decided improvement; milk, 39 lb. 1st January, 1925, condition good; weight of milk, 34 lb. 23rd February, condition first-rate; 34 lb. milk. This cow had no special treatment, the maintenance in health being due to the good rations.

"*Judy*," a red-and-white Shorthorn eight-year-old, arrived 22nd July, 1923, and calved 12th August, 1923. On 30th May, 1924, was in No. 1 paddock and condition good. 9th June, put into first break of turnips; turnips continued, but no hay; condition good. From 31st July to 31st August feeding as on 9th June continued; condition good until 7th September, when the swedes were finished. 30th September, caught a bad chill, and though covered and given hot drink, died of pneumonia on 6th October.

"*Molly*," a red Shorthorn seven-year-old, arrived 2nd July, 1923, and calved 12th August. On 30th May, 1924, continued in No. 1 paddock; condition good. 9th June, put in first break of swedes and hay. 30th June, still on swedes, but no hay; a good run-off available; condition good. This feeding was continued till 7th September, when swedes were finished. She calved on 25th September, the calf being strong and healthy, but, although cow's condition was good, she was unsuitable for milking owing to mammitis. She would not take to a strange calf tried on 30th September. On 1st November she was losing condition rapidly, and the strange calf died. On 15th December she was still going bush-sick rapidly, so was drenched with iron ammonium citrate made from commercial lime-juice, 1 fl. oz. twice daily. On 1st January, 1925, quite a marked improvement was noticeable. 23rd February, drenching continued; cow now in very fair condition.

"*Pansy*," a red Shorthorn six-year-old, arrived 2nd July, 1923; calved 14th August. 30th April, 1924, was dry, and from then to 30th May was grazed in No. 1 paddock, her condition being first rate. On 9th June was put on to first break of swedes, where she continued in first-rate condition till 30th June, with a good run-off but no hay. On 24th July she calved, the calf being strong and healthy. "Beauty's" calf was also given to her, but it died on 28th July. "Pansy's" calf remained in good condition, and cow continued on swedes until 7th September, when swedes were all finished. Since this date to 23rd February, 1925, both have done well. This cow developed mammitis, and was not milked.

"*Beauty*," a roan Shorthorn seven-year-old, arrived 2nd July, 1923, and calved 30th August. On 30th April, 1924, she was dry and grazing in No. 1 paddock till 30th May; in good condition. On 3rd June she was put into the first break of swedes, where she continued until 30th June, without hay but with a good run-off. Her condition was good, but not improving as she should. On 5th July commenced to give her 3 lb. molasses daily, which she took well. Calved on 25th July, the calf being weakly, and cow with dry, rough coat and signs of going bush-sick. On 31st July she was not taking molasses well. Calf died 28th July, having been put on to "Pansy." On 2nd August commenced to drench cow with home-made iron ammonium citrate made from commercial lime-juice, giving 2½ fl. oz. night and morning. The treatment was continued with hay and turnips, with no improvement noticeable. On 7th September swedes were finished. The medicinal treatment was continued twice daily; milk-yield, 23 lb. on 30th September. On 1st November weight of milk 27 lb.; a little improvement noticeable in cow. On 15th November quite an improvement; weight of milk 29 lb.; finished medicinal treatment by drenching. On 1st December much better milk-yield—29 lb.—but not as much as in previous year. On 1st January, 1925, condition good; milk, 24 lb. On 23rd February condition good; milk, 22 lb.

"*Blossom*," a red Shorthorn six-year-old, arrived 2nd July, 1923, and calved 11th September. On 30th April, 1924, she was dry and grazing in No. 1 paddock. On 31st May she was still in No. 1, and condition was no worse. On 9th June she was put on first break of swedes, with no hay but a good run-off. As she was

not improving on 5th July she was put on molasses and chaff treatment—3 lb. molasses daily, and turnips and hay carted to her. At 31st August she was looking a little better. On 7th September the swedes were finished, but she continued getting a little hay. At 30th September was looking better and springing, the molasses treatment being continued. On 8th October she calved, the calf being strong and healthy, but the cow was affected with mammitis, so was turned out with calf. Treatment finished. From November to 1st January, 1925, cow and calf did well. 23rd February, condition fair, calf doing well.

"*Bloi,*" a red Shorthorn, which arrived on 2nd July, 1923, slipped her calf. On 8th May, 1924, she returned from Tirau in good condition. On 30th June was springing and in good condition. On 10th July she calved—a bull calf, which was destroyed. Cow getting hay and turnips. On 31st July was giving 2½ gallons milk per day, her condition being good. On 3rd August giving 2½ gallons milk daily, getting hay and turnips, her condition still good. On 7th August finished feeding swedes. On 30th September was losing condition a little; giving 23 lb. milk. 1st November, looking better; giving 30 lb. milk. 1st December, picking up in condition quickly and giving 30 lb. milk. On 1st January, 1925, was in good condition and giving 27 lb. milk. 23rd February, condition good; milk, 23 lb.

FIG. 2. BRINDLE'S 1922 CALF—NOW FIT FOR BEEF.

HISTORY OF THE CALVES BORN AT MAMAKU FARM.

The following notes should be read in connection with and subsequent to the details given in the *Journal* for April, 1924, pp. 231–34.

Dam "Brindle."

This cow's second calf was born on 1st September, 1922—a white-faced Hereford bull (see Fig. 4, p. 233, *Journal*, April, 1924). On 30th May, 1924, he was turned on to turnips and young grass. On 15th June was running on swedes, where he continued up to 7th September, also getting hay. On 30th September he was turned on to the back part of the farm, his condition being good. He continued to remain in good condition until last noticed on 1st January, 1925, when he was fit for the butcher and in first-rate condition (Fig. 2 above).

Third calf, born 4th November, 1923—a brindle bull (see Fig. 5, *ibid.*). On 1st May, 1924, was weaned, and finished the feeding on molasses for a time; grazing on No. 1 paddock off turnips and young grass. At 16th May the two calves—"Darkie's" third calf and this one—which had been on molasses, were quite the best up to the time of weaning. At 30th May his condition was good; still grazing on soft turnips and young grass, and also getting about 2 lb. crushed oats once daily. On 5th June was turned on to the swede tops, but still getting crushed oats. At 30th June still feeding on swedes and getting a little hay; looking well. At 31st July was grazing on swedes and getting a little hay; had lost a little condition during the month. On 31st August was at a standstill, looking rough and not growing; still getting hay and turnips. On 1st September

commenced giving ¼ lb. molasses twice daily. At 15th September no improvement; still getting molasses. At 1st October the molasses were stopped; a slight improvement was now noticeable. Calf continued to graze in No. 2 paddock, recently top-dressed with ½ cwt. sulphate of iron per acre. At 1st December this yearling had improved during the month passed in No. 2 paddock. At 1st January, 1925, he was still grazing in No. 2 paddock, his condition being very good. At 23rd February he was doing well.

Fourth calf, born 4th November, 1924, is shown in Fig. 1, and is doing well.

Dam "Te Kuiti."

Second calf—a Jersey heifer born 6th October, 1922 (see Fig. 4, *ibid.*). The calf was originally of weak constitution. Had various treatment, and was reported to be going back, but owing to delay in receiving instructions was not given proper treatment, and died 3rd May, 1924.

Dam "Daisy."

Calf born 19th November, 1922—a red-and-white bull (see Fig. 4, *ibid.*). In May, 1924, he was in good condition. A strong calf, treated with iron ammonium citrate, home-made, in ¼ lb. molasses twice daily since 22nd April. A little improvement was noted on 30th May, when the treatment was increased by a little crushed oats and local chaff. By 30th June he had quite recovered, and was put on to the swede-paddock. At 31st July was still on swedes, with a little hay; slowly improving. At 31st August a good improvement was noted; still on swedes, with a little hay and a good run-off. By 7th September the swedes were all finished, and his condition was still improving. On 30th September was turned out on back paddock, where there was more feed; condition still good. On 31st October was doing well and in first-rate condition, which was maintained till 1st December. At 1st January, 1925, was at a standstill, or, if anything, going back in condition, although on good feed but not top-dressed pasture. At 7th February was going sick quickly; commenced drenching with iron ammonium citrate, with a little molasses.

Dam "Store Heifer."

Calf "Flora," born 25th August, 1922. At 10th May, 1924, condition of calf was good; still in No. 1 paddock. At 5th June in No. 4 paddock, receiving hay treated with commercial iron ammonium citrate incorporated with stack when building, and getting swedes daily. 30th June, still feeding as at 5th June; condition fair. 31st July, condition good. On 20th September the treated hay was finished, and "Flora" was running on cultivated pasture and springing to calve; condition first rate, which was maintained until 8th December, when a strong calf was born; cow in first-rate condition. 12th December, weight of milk 18 lb. 1st January, 1925, had lost a little condition during the month, but was giving more milk—*i.e.*, 25 lb. 23rd February, condition fair and doing well for a two-year-old; milk, 25 lb. At 28th December the calf was not doing well, scouring badly. On 1st January, bad with white scours. Died subsequently, shortly after New Year.

Dam "Cherry."

A strong healthy calf, born 17th October, 1923. At 30th May, 1924, was still on No. 1 paddock; lost condition through the month—weather rough. Getting 2 lb. crushed oats in a little local chaff once daily. At 5th June was turned out on swede-tops; still getting crushed oats. At 30th June was running on turnips and getting a little hay, but lost condition this month. At 12th July was going off quickly; was put on home-made iron ammonium citrate made from lime-juice, twice daily (2 fl. oz.), in warm water and a little molasses to sweeten it, which it readily took. Treatment was stopped on 31st July and calf put on swede-tops; condition about the same as on 12th July. From 4th to 20th August recommenced giving iron treatment, also molasses, and calf getting swedes and hay. At 21st August turned into swede-paddock, also getting hay and a good run-off. 31st August, a little improvement; still on swedes. 1st November, finished giving iron and molasses; quite a marked improvement in condition. In November was grazing in No. 7 paddock, recently top-dressed with iron oxide, super, and slag. At 1st December was in very good condition and grazing in the top-dressed paddocks. At 1st January, 1925, condition was good; still grazing in the top-dressed paddocks.

Second calf, born October, 1924—a roan bull, strong and healthy. At 31st October was feeding on new milk, and at 30th November on half new and half separator milk.

Dam "Polly."

A red heifer calf with white hind legs, born 20th October, 1923. At 30th May, 1924, was still grazing on No. 1 paddock; condition good; getting 2 lb. crushed oats once daily in chaff. 5th June, turned on to swede-tops, and getting crushed oats as well. 30th June, still on turnips, and getting hay; had lost condition through the month. 12th July, put on to No. 5 paddock; going back slowly in condition, although on good feed. Commenced giving sugar-iron brick and the run of haystack, also carted turnips. 31st July, taking sugar brick well; condition unchanged. 31st August, treatment continued, condition the same. 30th September, slight improvement noticeable; treatment continued.

FIG. 3. TREATED CALVES OF 1923 AT MAMAKU.

Three in front—left to right: Maud's, Daisy's, Mona's. Three at back—left to right: Beauty's, Polly's, Jean's. Note poor growth and condition of Polly's calf, apparently due to excess of sugar-iron brick.

20th October, taken off lick; quantity taken, about 1½ bricks a week. None of the three calves on this brick treatment had done as well as those on molasses or those getting iron ammonium citrate in water twice daily, with a little molasses to make it palatable. 1st November, condition about the same; then running on No. 7 paddock. 1st December, calf growing as well as it should; condition fair; grazing on top-dressed paddock. In January, 1925, calf was, if anything, losing condition, though running on the best of feed. (See note to dam "Daisy.")

Dam "Maud."

Heifer calf, born 28th October, 1923—strong and healthy. At 30th May, 1924, was still grazing on No. 1 paddock; condition good; getting 2 lb. oats in local chaff once daily. 5th June, turned on to swede-tops, still getting oats. 30th June, getting hay; in swede-paddock; lost condition through the month. 12th July, now losing condition all the time; put on to sugar-iron brick in No. 5

paddock, also had the run of haystack and getting turnips, carted. 21st July, no improvement, though taking the lick well and getting plenty of hay and turnips. 31st August, still getting sugar brick; no improvement. 30th September, same treatment, little improvement. 20th October, finished sugar-iron brick; slowly improving in condition, but not grown much; 1½ bricks taken per week. 5th November, a little improvement on this brick, but this animal had not grown like some of the others; now running on No. 7 paddock (top-dressed with super, slag, and iron oxide). 1st December, improving very slowly, but not growing much. January, 1925, like its mate, losing condition if anything. None of the three calves treated with sugar-iron brick is equal to the others. (See note to dam "Daisy.")

Dam "Daisy."

Third calf—a roan heifer with light strip in centre of back—born 5th January, 1924. At 20th May was still in No. 1 paddock; condition good; getting 2 lb. crushed oats once daily in chaff. 4th June, was turned on to swede-tops, where she remained up to 30th June, getting a few handfuls of crushed oats, but losing condition. 12th July, put into No. 5 paddock, having run of haystack; getting sugar-iron brick and carted turnips. 31st July, holding her own if anything, but little improvement; taking brick well. 31st August, under same treatment as on 12th July. Condition the same at 30th September. 30th October, finished lick; took 1½ bricks a week. Calf just about held its own through the winter. 25th November, condition about the same. The three calves under this treatment had not done so well as the others. In December this calf was in good condition, but, like its mates, had not grown like the other calves under different treatment. 1st January, 1925, now doing fairly well; grazing on top-dressed pasture. (NOTE.—The three calves of "Polly," "Maud," and "Daisy," which had the sugar-iron brick in winter, went on to it again on 20th January, 1925, and at 23rd February were still on this treatment, but getting a controlled quantity—not *ad lib.* as previously.)

Dam "Darkie."

Third calf—a brindle bull—born 16th November, 1923. On 16th May, 1924, was grazing on soft turnips. 30th May, still on turnips, getting 2 lb. crushed oats in local chaff once daily. On 1st June was turned on to swede-tops; getting handful of crushed oats daily. On 30th June was still on the turnip-tops, with a little crushed oats; in good condition. 31st July, feeding on hay and turnips all through this month; now put on to new break of swedes, also getting hay. 31st August, on turnips all through this month, and getting a little hay, but with a good run-off; condition good. 3rd September, condition good; grazing on pasture grown on cultivated land. 31st October to 1st January, 1925, condition good and similar throughout. 23rd February, doing well.

Dam "Spot."

Red-and-white bull calf, born 3rd July, 1923 (see Fig. 6, p. 235, *Journal*, April, 1924). On 1st April, 1924, was doing well, but on 30th May condition was not so good; on turnips and young grass, and getting 2 lb. crushed oats in chaff once daily. 1st June, put on swede-tops; also getting a few handfuls of crushed oats. Calf had not grown much since weaning. At 30th June was still on turnips and getting a little hay. At 5th July was going back quickly. Put on treated hay in No. 4 paddock; this stack (2 tons) had 5 lb. of commercial iron ammonium citrate scales mixed with a little molasses and sprayed on to hay when built. On 12th July calf was holding its own. At 31st July was still on the treated hay and getting turnips, and its condition was improving. At 31st August, with the same treatment, it was looking better. At 20th September, the treated hay being finished, it was put on to top-dressed pasture; condition fair. At 1st November was not putting on condition, but looked healthy; was then placed on No. 7 paddock, top-dressed with iron oxide, super, and slag. At 1st December was losing condition and showing signs of sickness. On 10th December commenced giving ¼ lb. molasses in a little oats; calf took it well; grazing on No. 2 paddock, which was top-dressed with iron sulphate (½ cwt. per acre) on 8th August, 1924. 1st January, 1925, condition maintained, no worse; treatment continued. 1st February, as no improvement had occurred, drenching with iron ammonium citrate with molasses was tried. This is a poor-constitutioned calf.

Dam "Mona."

Red-and-white heifer calf, born 5th August, 1923 (see Fig. 6, p. 235, *ibid.*). At 1st April, 1924, was doing well. At 30th April condition was not so good; weather rough; in No. 1 paddock. On 30th May condition was about the same; getting 2 lb. crushed oats in chaff daily, with soft turnips and young grass. On 1st June was put on swede-tops and given a few handfuls of crushed oats daily, but at 30th June had not grown much since weaning, being still under the same treatment; condition being about the same. On 12th July was given molasses in warm water twice daily. Calf had stopped growing and was going back quickly. 31st July, treatment continued; put on turnip-tops in new break; condition about the same. At 21st August the molasses treatment was stopped, and on 31st August condition was about the same. At 7th September the swedes were finished and the molasses treatment was recommenced. At 30th September was improving in condition. At 1st November molasses treatment was discontinued; condition was fair; was turned into No. 7 paddock (slag, super, and iron oxide). At 1st December was in very good condition and grazing on the top-dressed paddocks, and at 1st January, 1925, all the conditions were similar and the animal in good condition. 23rd February, doing well.

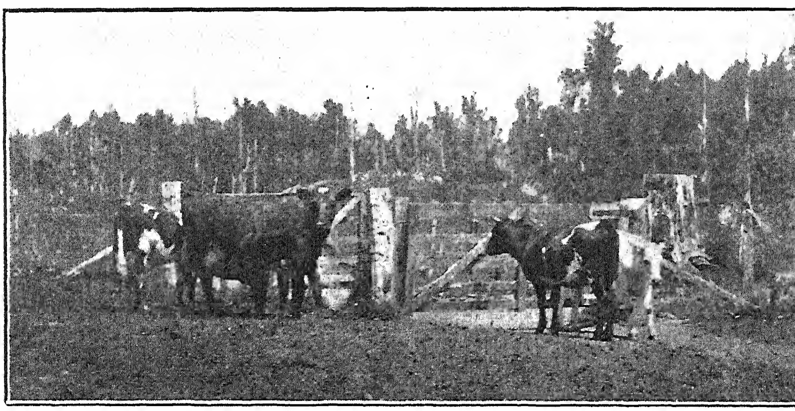


FIG. 4. ANOTHER LOT OF TREATED CALVES.

Left to right: Spot's (1923), Molly and calf (1924), Brindle's (1923), Fanny's (1923).

[*All photos by B. C. Aston.*

Dam "Fanny."

White bull, born 10th August, 1923. At 30th April, 1924, was grazing on No. 1 paddock, where he continued until 20th May; in good condition, getting crushed oats and chaff once daily. On 1st June was grazing on swede-tops with a few handfuls of crushed oats and chaff once daily, which was continued until 30th June, when he was losing condition, not having grown much since weaning. At 12th July was going back quickly and was put on to home-made iron ammonium citrate made from commercial lime-juice, given 2 fl. oz. twice a day in a little warm water, with ¼ lb. molasses in it to make him take it. At 30th July, the medicinal treatment being continued, he was put on swede-tops in new break; condition still poor. At 31st August was looking better, being still on the swedes. On 7th September, the swedes being finished, he was put on to the treatment started on 12th July, and on 30th September a great improvement was noticed. The medicinal treatment was continued until 1st November, when, being in first-rate condition, the treatment was discontinued and calf placed in No. 2 paddock (top-dressed with iron sulphate). His condition up till 1st January, 1925, was first rate, and he was continued grazing in No. 2 paddock. 23rd February, doing well.

Dam "Jean."

Red-and-white bull calf, born 10th August, 1923 (see Fig. 6, p. 235, *ibid.*). On 3rd April, 1924, was on No. 1 paddock, with soft turnips, and getting a little crushed oats in chaff; weather very rough. On 1st June was put on to swede-tops, with a little crushed oats; continued there till 30th June on this treatment, and was then losing condition, not having grown much since weaning. On 12th July was going off quickly, so was given 1 lb. molasses twice daily in a little warm water, a treatment which was continued until 21st August, when he was turned into the swede-paddock, with a little hay. On 7th September the swedes were finished and the molasses treatment was recommenced. At 30th September a good improvement was noticeable. On 1st November molasses treatment was discontinued; was put in No. 7 paddock (super, slag, and iron oxide). At 1st December was in first-rate condition and grazing on the top-dressed paddocks. Same at 1st January, 1925, his condition being then first rate. 23rd February, doing well.

Dam "Beauty."

Red heifer calf "Rose," born 20th August, 1923. At 30th April, 1924, showing signs of sickness. 10th May, commenced giving 2 oz. iron ammonium citrate in milk with ¼ lb. molasses twice daily; grazing on No. 1 paddock, soft turnips and young grass. 30th May, condition about the same; giving little crushed oats daily in chaff; very rough weather; feeding as on 10th May; calf improving. At 20th May continuing to improve, though low in condition. On 31st July was still improving and was put on swede-tops, the medicinal treatment being continued. On 20th August the medicinal treatment was stopped, and on 31st calf was looking better, being on swedes and a little hay. On 7th September, the swedes being finished, the treatment was recommenced, and on 30th September calf was looking well. At 1st November the treatment was discontinued, and calf was grazing in No. 7 paddock. She continued in good condition to 1st January, 1925, grazing on top-dressed paddocks. On 23rd February she was doing well.

Dam "Maggie."

Second calf, born 30th September, 1924, strong and healthy. At 1st November was getting new milk. Doing well in December, getting half new and half skimmed milk. At 1st January, 1925, was still doing well on quarter new and three-quarters separated milk, and 3 oz. of fluid molasses twice daily.

CURATIVE TOP-DRESSING OF PASTURE.

For the cure of iron-hunger the writer advises the top-dressing of pasture with ½ cwt. per acre of sulphate of iron (ferrous sulphate). This is a small dressing, and it is not advisable to increase it or to mix it with soluble phosphates before applying it to the soil; but it is permissible to mix it with any ground phosphate which is insoluble in water, such as Nauru ground rock, bonedust, or basic slag. The difficulty of applying such a small dressing as ½ cwt. is then got over. It is also permissible to spray closely cropped or mown pasture with the iron sulphate dissolved in water; 3½ lb. dissolved in 4 gallons of water will be enough for $\frac{1}{16}$ acre of land. Messrs. Wright, Stephenson, and Co. (Auckland), Messrs. Kempthorne, Prosser, and Co., and others stock this compound. The first-named firm has a fairly large quantity for sale at 13s. per cwt., finely ground.

The work of the farm has continued under the immediate control of Mr. Jackson, to whose capable and energetic direction much of the success attending the experiments is due. He has been well supported by Mr. MacMillan, his assistant. Mr. J. Lyons, M.R.C.V.S., District Superintendent at Auckland, exercised supervision over the operations and the farm as a whole.

THE RAISING OF FERRETS FOR RABBIT-CONTROL.

D. MUNRO, Inspector of Stock, Wanganui.

INQUIRIES have been received lately from farmers concerning the raising of ferrets or stoats, with a view to maintaining a steady supply of the "natural enemy" of the rabbit. The animal of this class which is usually bred for rabbit-control in New Zealand is the ferret, and the following notes deal specially with it. Very little breeding of stoats or weasels in captivity appears to have been carried out in this country, but, generally speaking, principles of breeding, feeding, and handling are the same for these animals as for ferrets. The latter are found to be more easily domesticated than stoats or weasels.

The number of litters produced annually by the female ferret will vary from one to two, but the majority of does will have one litter only. Does giving birth to their first litter, say, in September or October will frequently have a second litter in February or March. The period of gestation is from forty to forty-two days, and the average litter seven.

When pregnant the does must be separated, and each kept in a box or pen by itself. At this time the doe becomes very savage, and if left in the pen with others there is bound to be trouble, and generally the litter when born meets with a sudden and tragic end. For at least ten days after birth the young should not be examined or handled. If the nest is opened or interfered with in the first three or four days after birth of the young the mother will very frequently destroy them.

While suckling her young the doe should be given a plentiful diet of new milk and oatmeal porridge, say, twice daily, which may be supplemented occasionally with meat (rabbit). When about three weeks old the young will commence to feed on porridge and milk. Meat diet should not be given until they are eight or ten weeks old. The meat should be either rabbit or hare; mutton should not be fed to the young animals.

Ferrets are very susceptible to a form of distemper, which generally proves fatal. As a preventive measure it is always advisable to have the pens or boxes separated in groups at a distance of, say, 100 yards, so that should distemper break out in one colony it may be isolated there. The attendant looking after animals suffering from distemper should not go near the other colonies.

A simple but useful breeding-pen can be made from an ordinary strong packing-case, of dimensions about 2 ft. 6 in. high, 3 ft. wide, and 4 ft. or 5 ft. long, with the lid on top covered with malthoid or other waterproof substance. One end of the box—say, 18 in.—should be partitioned off as sleeping-quarters and filled with soft straw or hay, the remainder of the box being the feeding-place. The latter part should be freely perforated with $\frac{3}{4}$ in. auger-holes to allow free drainage of any liquids. Plenty of ventilation is essential in this apartment, and may be provided by cutting out a section in the end or sides of the box, over which a piece of perforated zinc is tacked securely. A hole, 6 in. by 6 in., should be cut in the partition near the floor to give access

to the sleeping and feeding apartments. A box of this description will give as good results as the most elaborately built house. Further, in the event of an outbreak of distemper the box with all its contents can be burnt, which one would hesitate to do with a more expensive structure.

Non-poisonous dip should be used freely in washing down the breeding-pens, and a good sprinkling of sawdust on the floor of the boxes will make cleansing operations more easy. This should be done daily. The boxes should be raised about 1 ft. from the ground to allow a free current of air to pass under. This may be done by nailing battens on to the four corners to serve as legs, and in this way the boxes may the more readily be moved on to clean ground as the old spot is fouled.

The first symptoms of distemper are loss of appetite and watering of the eyes, with mucous discharge from nostrils, similar to a cat or dog suffering from this complaint. The more virulent form is frequently followed by a partial paralysis of the hind quarters, and in cases where paralysis or fits are developed it is advisable to destroy the animal and burn the box and bedding.

Unless the boxes are kept thoroughly clean the ferrets will readily become affected with foot-rot. Animals so affected should be treated by rubbing in a mixture of sulphur, lard, and Stockholm tar. A thin paste of sulphur and lard should be made, after which add one part Stockholm tar to ten of the paste, mix thoroughly, and apply to the affected part with the fingers. Give two or three applications, one each second day, then wash the foot with warm water and soap, when the trouble will generally disappear.

When the young ferrets are matured they may be grouped into pens of twenty and thirty, and if possible before being liberated should be fed for two or three weeks on whole rabbits with the skin intact. Young ferrets artificially raised on porridge and milk, if liberated without such training, will frequently die of starvation. The best results will be obtained by carrying them over the winter and liberating them in the spring when there are plenty of young rabbits about.

The most important matter in the care of ferrets or stoats is cleanliness; if they are kept thoroughly clean little or no trouble should be experienced.

When handled these animals should be picked up by the tail, placed across the knee, and caught round the shoulders, one finger in front and one behind the shoulder. They should not be grasped tightly round the abdomen. If they are vicious a leather glove may be used.

FRUIT-EXPORT CONTROL BOARD.

FOLLOWING the recent polls, the following have been appointed as producers' representatives on the New Zealand Fruit-export Control Board: H. S. Izard (Auckland and Taranaki), A. M. Robertson (Hawke's Bay and Wellington), T. C. Brash and H. E. Stephens (Nelson and Marlborough). Messrs. E. H. Williams and C. Gray have been appointed Government representatives on the Board. Otago was excluded from control on petition of not less than 70 per cent. of eligible exporters, and thus has no representative on the Board.

"PREPARED" CHEESE AND THE BRITISH MARKET.

A REMARKABLE DEVELOPMENT.

G. D. MACFARLANE, New Zealand Produce Association (Ltd.), London.*

AN interesting development in the cheese industry has taken place during the last year or two. Hitherto there has been no serious competitor with the cheddar type as made in Britain, Canada, and New Zealand. This dominates the market, and will continue to do so for some time. The latest development in cheese, however, is rather disconcerting, and the enormous increase in the sale of the type in question is so remarkable that I had samples forwarded to New Zealand recently for the inspection of the Dairy Division and others interested.

This cheese is what may be termed a prepared cheese, and is made from ordinary cheddar of good quality. The latter is ground down and treated so as to reduce it to a pulpy form. It is then moulded by machinery into 5 lb. blocks in the same way as we mould pounds of butter, tinfoiled all round in order to retain the moisture, and packed in oblong boxes. A ½ lb. indicator paper is placed on top for the guidance of the seller in cutting. The boxes are packed in parcels of five, bound at both ends with wire. There is no rind on this cheese, and none develops. The lots I received must have been five or six months old; the cheese was quite moist, and no undue ripeness had developed.

It can readily be understood that a rindless cheese of good flavour, that can be spread on bread almost like butter, is attractively put up, and assures the retailer a fair profit, without any waste or shrinkage, is bound to have a fair sale. This type of cheese suits the small shopkeeper to perfection. His complaint has always been that the large cheddars dry up so rapidly, especially when his sales are slow, as is usually the case with the smaller men, resulting in virtually no profit, if not a loss. Whereas, this new type of prepared cheese being a proprietary article, its price is fixed by the manufacturer to the wholesaler, whose profit is fixed, and the retailer in his turn has to sell at a fixed price showing him a profit of around 16 per cent.

As recently as some eighteen months ago many of the larger wholesalers in Britain did not stock this cheese, looking upon the demand as a passing phase. Their customers, however, insisted on getting the article. As an illustration of what has happened it may be mentioned that the Scottish Co-operative Wholesale's grocery manager was strongly opposed to stocking this cheese, as he considered it would have a short life. Later the demand became insistent, and he ordered 250 packages. These sold freely, and the demand increased so rapidly that when I left Scotland they alone were selling around 8 tons per week. In a recent letter this gentleman, knowing my interest in the matter, refers incidentally to the prepared cheese as follows: "Trade in this cheese is increasing very rapidly, and at the moment the manufacturers have not been able to overtake orders. They are sending fairly large quantities to the Continent, and another large factory is being erected by them."

* Mr. Macfarlane (Woodville) is now on a visit to New Zealand.

The *New York Produce Review and American Creamery* of 29th October last makes the following reference to this class of cheese :—

There is no question that loaf cheese has played havoc with the retail demand for so-called bulk cheese in the United States. However, more and more manufacturers are getting into that end of the business, most of them well capitalized and representing large interests. Competition in loaves has grown keener and keener, and undoubtedly under the forces of this competition the margin of profit has been reduced. Our personal opinion is that the only opportunity now for profitable development of such a line lies either in starting on a very limited experimental scale and building as returns permit, or entering the business with large capital after having procured the rights to a process which not only gives a popular produce, but which does not infringe any of the patents under which loaves are now being made. Patent rights on the processes under which the Kraft and Phœnix interests manufacture are held by these concerns, and they do not recognize the right of a number of others to use the "cooked cheese" methods that are now being used. At least one suit charging infringement is pending in the Courts to-day. The cooked loaf has the advantage of better keeping-qualities than most of the so-called "natural" loaves that have been brought out, though the latter are in some cases being very successfully marketed, either ground or unground. But to market loaves on a large scale, either cooked or uncooked, the investment necessary is large and the profits modest.

This class of cheese is being retailed at 50 per cent. over New Zealand or Canadian cheddar prices. That being so, it will readily be seen that it is a highly remunerative proposition for the manufacturer. Ordinary selected Canadian cheddars are bought at market price, and at certain periods New Zealand cheese has also been shipped to America for these people.

The question arises, Can the New Zealand dairy industry afford to ignore this new development ? In my view it cannot.

INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 31st December, 1924, to 26th February, 1925, include the following of agricultural interest :—

No. 51606 : Milking-machine automatic cut-off ; S. M. Potter, Mercury Bay. No. 52311 : Fence-dropper ; A. F. Johns, Rangiora. No. 53073 : Wine preserving and maturing ; A. Newmark, Fairfield, Victoria. No. 51582 : Sheep-drenching instrument ; R. O. Montgomerie, Makirikiri. No. 51631 : Cream-separtor driving-gear ; C. F. Shaw, Hokianga. No. 52948 : Rake attachment ; W. M. Stewart, Masterton. No. 53223 : Sheep-shearing tool ; Chicago Flexible Shaft Co., Chicago, U.S.A. No. 51385 : Disk plough and sledge ; R. Denham, Awatere. No. 52497 : Teat-cup inflation ; T. M. Timpany, Woodlands. No. 53314 : Preserving-jar ; A. Gunn, Sydney, N.S.W. No. 51587 : Milking-machine ; S. H. Knapp, Greytown. No. 53210 : Chicken-brooder ; H. A. Dawber, Ouruhia. No. 53304 : Milking-machine ; L. A. Sheehan, Ashgrove, Queensland. No. 53341 : Sheep-dipping apparatus ; A. C. Stewart, Arrievean, Scotland.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price, 1s.

Proposed Registration of Sheep-dips.—This question was referred to the Board of Agriculture by the Department for its recommendation. At its February meeting the Board came to the decision that registration was warranted in order to prevent worthless mixtures being placed upon the market, and recommended that legislation be framed on somewhat similar lines to the Fertilizers Act.

FIELD EXPERIMENTAL WORK IN THE KING-COUNTRY.

OPERATIONS AT ARIA.

J. E. F. JENKS, N.D.A., Assistant Instructor in Agriculture, Auckland.

KING-COUNTRY lands can be divided roughly into two classes—bush and fern—together with a limited amount of swamp. The bush country comprises the higher and steeper ridges and slopes; the fern country is found chiefly on the lower and more accessible ridges and undulations, and it is with this class of land that the work at Aria has been occupied. It is characteristic of fern country that all the larger forms of forest growth are absent, the principal vegetation being bracken-fern, fair-sized manuka, and tutu. The soil is for the most part a loose sandy loam, somewhat deficient in humus, with a subsoil of a stiffer nature: papa frequently occurs some feet below the surface. Evidence goes to show that this land was once forest-clad, and that successive fires during the course of many years have resulted not only in the destruction of the forest and all traces of it (save for occasional stumps), but in a marked physical change in the soil. The bracken-fern and manuka stage is without doubt an intermediate one, destined by nature to last until the supply of humus is restored sufficiently to enable the forest-trees to re-establish themselves.

Pioneering settlers have in the past somewhat neglected this class of land in favour of the bush fellings. Its light open soil seldom "holds" good permanent pasture without consistent manuring; in the absence of the latter the grasses and clovers soon give way to rib-grass, cudweed, hawkweed, and bracken-fern. Now, however, that the steeper bush country is becoming each year more difficult to control (as regards second growth, &c.), the prime importance of ploughable land, on which crops may be grown and hay cut for winter feed, has become obvious. Again, the expansion of dairying has accentuated the position, since the milking-cow, while unsuitable for crushing fern on the steeper slopes and wintering on rough feed, will yield a return per acre large enough to cover considerable expenditure on manure and cultivation. In the past the customary method of managing open fern-land has been to crop it with turnips or rape for one or two years after the first breaking, and then to sow it down with a thin seeding of rye-grass, cooksfoot, and clovers. No more would be done till, in the course of a few years, the pasture became exhausted and overgrown with fern, when the cropping and grassing would be repeated.

The object of the Aria experiments is to demonstrate not merely the suitability of this land for farming purposes (which is indisputable), but the various ways in which it can be cropped so as to improve the farm-economy of the district, and the possibility of establishing and maintaining on it, by means of suitable manuring and management, a good permanent turf. The centre of the experimental work is a block of approximately 15 acres loaned to the Department by Mr. John O'Sullivan. This block lies just south of the Township of Aria, and consists for the most part of a section across a low, steep-sided spur,

though there is also a strip of water-logged flat which has not yet been improved. When, at the request of the local settlers' association, work was first started in 1921 the ridge was in poor grass (sown in 1905 after one crop of turnips), and largely overgrown with bracken-fern except at the higher points where stock had made a practice of camping. It was typical of deteriorated fern-country pastures. In the summer of that year some 5½ acres (Fields L, M, and part of F—see sketch-map*) were broken up and cropped with turnips, but owing to the financial stringency prevailing at that time experiments were temporarily abandoned and the land was sown to temporary pasture in the autumn.

SUMMER FEED.

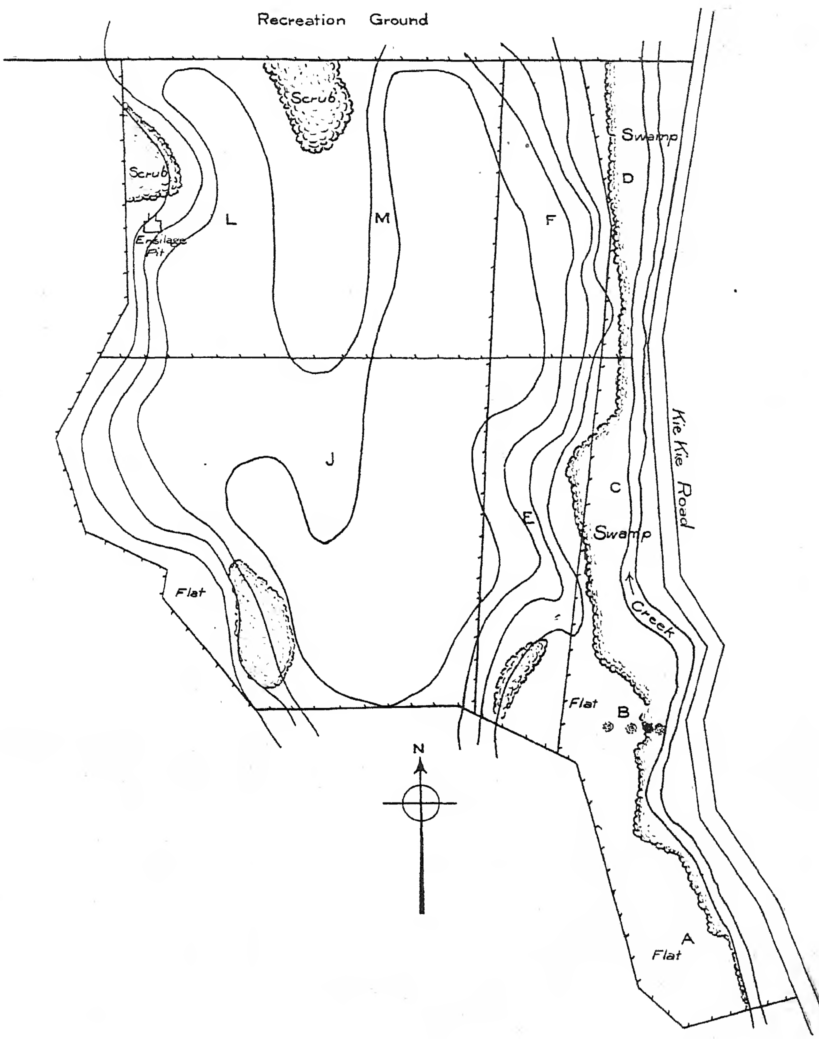
Work was recommenced in October, 1923, some 3½ acres of the temporary pasture and ½ acre of sidling (Field F) being broken up for summer feed. Japanese millet sown at the end of November was a distinct success, a good growth of succulent feed being obtained throughout the dry weather of January and February, despite the comparative poverty of the land and the light manuring—2 cwt. super and 1 cwt. ground limestone per acre. Red clover sown with the crop did not strike well. Red Paragon turnips sown at the same time, with the same manure, made good young plants, but did not develop well owing to lack of rain; neither did the red clover sown with them. The importance of early and thorough cultivation (including rolling) was demonstrated by the even stand obtained with both millet and turnips under distinctly dry conditions. Turnips and clover sown broadcast on the sidling where the latter was too steep to roll or drill were practically a failure.

WINTER FEED.

The remaining 2½ acres of temporary pasture (Field L) were top-dressed in October, 1923, with super and lime, with indifferent results. The land was ploughed in the following February (1924), and sown in late March in various fodder crops in ½-acre plots as follows, the quantities given being per acre: (1.) Italian rye-grass, 20 lb.; crimson clover, 10 lb. (2.) Algerian oats, 2½ bushels; Scotch tares, 1 bushel. (3.) Algerian oats, 3 bushels. (4.) Rye-corn (Emerald), 2 bushels. (5.) Barley (Black skinless), 2 bushels. Manure—3 cwt. basic super per acre—was applied in each case.

These crops were intended for grazing in August and September—a very difficult period for both dairymen and sheep-farmers—but owing to the mild autumn they had to be grazed back in June. This grazing was a little overdone, with the result that they were not fit to feed again till mid-September. However, some valuable information was afforded in regard to these crops, which are of considerable value to farmers who are not yet in a position to grow mangolds or save any quantity of hay. The Italian rye-grass and crimson clover made comparatively little autumn growth, but came away well in the spring, and yielded in December a crop equivalent to 2 tons of hay. The Algerian oats threw a good deal of autumn feed, but were backward in the spring and did not make much subsequent growth. They were attacked in patches by rust in the autumn. Oats do not

* The writer is indebted to Mr. E. Tolme, Aria, for assistance in preparing this map.



SKETCH-MAP OF THE EXPERIMENTAL BLOCK AT ARIA.

appear to be an ideal fodder crop for winter use on such light land. For the best results they should be sown in April and allowed to stand till September. The tares were not a pronounced success, being better suited to land of a heavier nature. The Emerald rye-corn did well, germinating quickly, and stooling out with its usual vigour. Contrary to a common belief, the stock relished the feed and grazed the plot closely; it was the first to come away again after stocking. This crop is to be recommended for winter grazing on light land, though, like barley, it is useless for fodder purposes once it has shot into ear. The Black barley grew at a phenomenal rate during the autumn, being

12 in. high by the beginning of June (ten weeks from sowing). It was therefore too rank when stocked, and in consequence was not properly grazed. Like the rye-corn, it appears to have decided merits as a catch-crop for winter use, but as it does not stool out well it should be sown fairly thickly—say, at 3 bushels per acre. Both these crops should be sown in early March for grazing in May and again in August and September. If sown at the end of April they could give valuable feed by early August, but in either case should be ploughed in after grazing in the spring.

SPRING-SOWN CROPS FOR ENSILAGE.

In order to provide fodder for ensilage-making, Field M was devoted this season to further fodder crops. This field grew millet and turnips last season, and was ploughed last winter. On 27th August the following crops were sown, the rates being per acre: (1.) Algerian oats, 2 bushels; grass-pea, 80 lb. ($\frac{1}{3}$ acre). (2.) Algerian oats, 2 bushels; Partridge peas, $1\frac{1}{2}$ bushels (1 acre). (3.) Algerian oats, 2 bushels; Scotch tares, $1\frac{1}{4}$ bushels (1 acre). Manure in each case, 3 cwt. basic super per acre.

The crops suffered severely from bird-attack—a serious objection to early spring sowing in this district; but the oats developed into a crop estimated at about 8 tons per acre green. Of the legumes, the Partridge peas did best, but their growth was by no means vigorous. Both the tares and grass-peas were comparative failures, being stunted and sickly. This seems to indicate a distinct shortage of available lime in the soil.

ENSILAGE-MAKING.

Ensilage-making could with advantage be made a regular farm practice in the King-country, partially as a substitute for the now precarious swede crop, and partially as a solution of haymaking difficulties in a wet climate. Little has been attempted so far, but the demonstration given on the experimental area this season evoked considerable interest, and several settlers are adopting this method of conserving winter feed.

A small "hillside" pit was dug in Field L, this method being deemed the most suitable for local conditions, since few settlers can afford either a permanent silo or stacking apparatus. A pit approximately 12 ft. square by 8 ft. deep was constructed by contract labour at a cost of £7. It is estimated that a pit of this size should hold from 30 to 35 tons of settled silage. The material for ensilage-making consisted of the various crops from Fields L and M, mainly oats and Italian ryegrass, with a foundation of suckling-clover. The filling was done on 12th and 13th December, about 16 tons being put in on the first and 20 tons on the second day. The temperature before weighting with earth on the 15th had reached 125° F. The work was performed voluntarily by local settlers interested in the question of ensilage.

GRASSING.

Field F consists of a slope of loose friable soil, faces east, and is about 1 acre in extent. It was originally ploughed and grassed with the rest of the land, but reverted badly to bracken-fern. As has been stated, the top part was ploughed in 1921 and the whole in 1923; some of

the red clover sown in the latter year still persists. This piece is typical of much land in the district—just ploughable, but too steep for either the drill or the mower. In July and August, 1923, the land was worked up with disks and harrows. On 31st August 3 cwt. basic super was sown, applied by hand, and on 1st September various grass-mixtures were sown, the ground being then tine-harrowed. Three plots have been set out as follows:—

(1.) Italian rye-grass, 9 lb.; Hawke's Bay rye-grass, 9 lb.; paspalum, 6 lb.; red-top, 3 lb.; Chewing's fescue, 3 lb.; Poa pratensis, 1½ lb.; cow-grass, 3 lb.; Lotus major, ½ lb.; wild white clover (imported Kentish), ¼ lb.; subterranean clover, ½ lb.: total, 35¾ lb. per acre.

(2.) Cow-grass, 3 lb.; Lotus major, 1½ lb.; subterranean clover, 1½ lb.: total, 6 lb. per acre.

(3.) Italian rye-grass, 6 lb.; Hawke's Bay rye-grass, 6 lb.; cocksfoot, 6 lb.; crested dogstail, 3 lb.; brown-top, 3 lb.; cow-grass, 3 lb.; Lotus major, ½ lb.; wild white clover (imported Cotswold), ¼ lb.; Danthonia pilosa, 6 lb.; Danthonia semi-annularis, 3 lb.: total, 39¾ lb. per acre.

Plot 2 was partially planted with kikuyu-grass (from the Albany Experimental Area) on 23rd October. A good take of practically all the species has been obtained, and these plots should furnish a rough guide as to the comparative value of the various grasses and clovers under such conditions.

TOP-DRESSING OF PASTURE.

Four series of plots have been laid out with a view to demonstrating the value of phosphatic manures and lime on permanent pasture. Two of these series are on undulating fern country, in one case on very poor light land, and in both cases on decidedly deteriorated pasture; the third is on a river-flat carrying a comparatively good turf; and the fourth is on Field E, a steepish slope where the bracken-fern is fast overshadowing the weakening grasses and clovers of the original sowing. The manure was applied at the end of July. In every case the value of the phosphates has been fully demonstrated in the improved colour and vigour of the turf, the increased clover content, and the decided preference shown by live-stock for the manured plots. At the time of writing (January) there is little to choose between super and super plus lime: basic slag has given gratifying results, but has not yet proved so potent an agent as super. Further observations will be made later.

GENERAL.

There is ample scope for experimental work in the King-country, and farmers are keenly alive to the necessity for improved methods. A new local committee has been formed, and the more energetic settlers have readily come forward to assist with the erection of fences and other work. A considerable amount of pasture top-dressing is now carried out in the district, and on this point, as well as others, the advice of the Fields Division officers and the evidence of the plots are frequently sought. It is always difficult to conduct careful experiments on a co-operative basis, however helpful (as in this case) the co-operating farmers may be, but in the meantime the Aria experimental area is serving both as an object-lesson and an encouragement to a district that needs and appreciates both.

SEASONAL NOTES.

THE FARM.

CULTURAL AND CROPPING OPERATIONS.

IN Canterbury and other South Island districts with similar conditions the teams from now on should be working at high pressure preparing land for wheat and oats. There is no advantage in sowing wheat too early—May and June being the best months—as autumn flights of Hessian fly are liable to injure the young plants. The earlier sowings of wheat should be light—say, 1¼ bushels per acre—as the land is usually in good condition and the stooling of plants greater. Further sowings of oats can be made in the coming month. Cape barley is not as serviceable as Algerian oats for winter feed for sheep. Black Skinless barley is best suited to early spring sowing, owing to its very rapid growth. In the North Island, as a general rule, wheat gives the best results when spring sown, but oats may be sown any time now. Algerians usually give the best results; for autumn sowing 2½ bushels per acre is ample.

In preparing a seed-bed for autumn-sown cereals it is advisable to work the land fine underneath but leave it somewhat lumpy on the surface; this condition affords a certain amount of shelter for the young plants and prevents the soil from running together. In ploughing lea land a good deep furrow should be turned. Too often the ploughing is of the same depth each season; it is advisable to vary it each year so as to avoid the forming of a pan.

Any stubble or other vacant land should be ploughed at once and either sown in a green crop or left to fallow. Very stiff wet land is greatly benefited by a winter fallow; but the lighter North Island lands are apt to leach badly if left fallow, and for this reason they are usually better sown in a green crop. Suitable forages for this purpose were mentioned in last month's notes.

Advantage of the winter months should be taken for cleaning yarrow-infested lands. If ploughed now sheep can very profitably be grazed on the ploughed land, as they thrive on the yarrow-roots.

CROPS AND FEEDING.

Cocksfoot-paddocks from which seed has been taken should not be stocked till July, as the April growth of leafage assists next season's production. Late-sown rape-paddocks having been once fed, especially if sown with grass-seed, may be closed for early spring feed for ewes and lambs. Rape land should be ploughed now if required for winter-sown cereals. If dry-rot has made its appearance in the swede crop, and shows signs of spreading, the roots should be fed off without delay. Crops like maize and millet should be cleaned up as far as possible during April, as they are easily damaged by frosts. In most dairying districts the cows will be dried off during May, and every opportunity should be taken by generous feeding to get them in as good condition as possible before they go out.

LIMING.

The coming month is a suitable time for liming operations, it being a great advantage to get the carting done before the land is too wet. Lime is best applied to the ploughed surface, as it quickly works down. The question as to which form of lime to use is one for each farmer to determine for himself. In many districts carbonate of lime (raw crushed limestone) is satisfactory, but if very quick results are desired the burnt form should be used. Again, if the lime has to be carted long distances there is a saving in haulage in the case of burnt compared with the carbonate, as about 12 cwt. of the former is equivalent to 1 ton of the latter. Against this advantage the greater cost of burnt lime must be taken into consideration, this being on average some 70 per cent. more than for the carbonate. The unpleasantness of distributing burnt lime is also a factor in the pros and cons.

Except where the land is of a very sour nature the best results are usually obtained by light and frequent dressings, as against heavy dressings at long intervals—say, 6 cwt. to 10 cwt. of carbonate or half this quantity of burnt. Considerable benefit may be derived from even half these quantities. It should be remembered that liming cannot be fully efficacious unless the land is properly drained.

LUCERNE.

After the last cut of the season has been taken the stand should be closed for winter, and not trampled by stock as is frequently the case. The autumn cultivation is best done with at least two strokes of the rigid-tined cultivator to a depth of 5 in. to 6 in., and the land left in a rough state to be mellowed by the effects of frost. Early cultivation will allow the stand to make a few inches of protective growth before severe weather sets in. Lucerne will benefit by autumn applications of lime or manure at the time of grubbing the stand; 10 cwt. per acre of ground burnt lime or 2 cwt. per acre of super are suitable dressings.

Land in which it is intended to sow lucerne next season should be ploughed during the autumn, limed, and thoroughly cultivated through the winter. These cultivations germinate and destroy weed-seeds, especially when continued in the spring. They also promote the firm, sweet seed-bed so necessary in the establishment of lucerne.

GROWING LUPINS FOR SEED.

The growing of blue lupins for seed is on the increase in the Marlborough and Nelson Districts. Sowing may be carried out with advantage during April, the optimum rate being about 1½ bushels or 90 lb. per acre. A mixture of 5 cwt. lime with 1 cwt. super, or ½ cwt. super mixed with ½ cwt. rock phosphate, constitutes a satisfactory fertilizer. The crop is best cut with the binder, as the small sheaves may then be stooked in round stooks with a fork. If the pods then split, as they frequently do, the seeds fall into the centre of the stook, and are less easily lost than when the crop is cut with the ordinary mower. For this reason it is a wise precaution to leave a strip of about 5 yards undrilled all round the headlands, thus obviating the necessity of opening out with the binder.

MISCELLANEOUS.

Stacks of late-harvested cereals should now be securely thatched and made snug for winter if not intended for early threshing or chaffing. It is also wise to plough a few furrows round the hay or sheaf stacks as a precaution against fire spreading to them by a carelessly dropped match.

New season's chaff, if it has not been properly matured by a few weeks in the stack, is very prone to heat, and if it has to be bagged should be left as loose as possible. The effect of immature chaff will usually be noticed in the team by swellings on the legs, especially if it is fed suddenly. The better plan is to mix it with old chaff and gradually accustom the animals to it, until the material in the stack is properly sweated and matured.

The outlets of all drains should now have attention, so that water may get away rapidly during the winter months. Plans for winter and spring drainage should also be put in hand; the work may be then done when opportunity offers.

—*Fields Division.*

MATING THE EWE FLOCK.

When all the rams are turned into the same paddock with the ewes it is often noticed that they spend a great deal of their time and energy in fighting each other for possession of the first ewes to come in season. The effect of this fighting is reflected later on during the period of mating. The following plan will be found decidedly advantageous on the smaller sheep-farms, though it cannot be adopted in every case, particularly on large stations: First separate the ewes into small lots of about fifty to sixty in each paddock, put a ram in with each lot, and leave them for a fortnight. Then mix every two lots, leaving them together for ten days. Next mix them all, and let them run together until the rams are taken out at the end of the season. The idea is that each ram is first of all put with a separate lot of ewes; therefore he is undisturbed and can pay strict attention to business for a full fortnight. By the time the mixing of every two lots takes place each ram has steadied down a good deal, and fighting will not take place nearly so readily as would have been the case had all been put in together in the first place. When the mixing takes place each ram will pick up the ewes that the other one has missed, and after the mixing of the whole lot there is every chance of each ewe having been served before the rams are finally taken out.

Another method is to hold a small number of rams in reserve until half-way through the mating-period, and then turn them in with the others. Being quite fresh, they will sort out the ewes not yet served. Either method leads to an increased lambing, but the first-mentioned plan is recommended where practicable. It has been tried and has always given good results.

—*J. G. Cook, Live-stock Division.*

THE ORCHARD.

PREPARING FOR EXTENSIONS.

THE next two months will keep growers very busy picking, packing, and marketing all midsummer and late varieties of apples and pears. This doubtless will occupy a large portion of their time, but it is poor orchard practice to complete one job before the next one is well thought out and planned. The question of further planting will have to be considered, and where extension of orchard areas is contemplated it will be necessary to fix upon varieties. When this has been settled an order should be placed early with a good reliable nurseryman, so as to ensure supply of the trees required. Early selection and preparation of the land should also be carried out, thereby giving the young trees a chance to do their best. The object should be to select only the best varieties. Until this is done we shall always have unproductive trees that never will prove worth the space they occupy.

The land should be given a first ploughing during the autumn, and any fencing that may be necessary may be done in any spare time. This will enable growers to keep abreast of their work. Fruit-trees will do well on different varieties of soil if they are given fair treatment with respect to drainage, shelter, and cultivation.

AUTUMN SPRAYING.

The only spraying necessary during March may be for woolly aphis. This pest has given considerable trouble in the past, but indications are that it is one which will no longer be dreaded. The natural enemy, *Aphelinus mali*, is doing good work in many orchards. Should the weather continue hot and dry it may be wise to make a late application of arsenate of lead for the control of codlin-moth and Leaf-roller caterpillar on late varieties of apples, after which the spray-pump can be put away for a short period. It is good practice to destroy all infected and diseased fruit which has fallen to the ground in the orchard, also any that may be in cases in packing-sheds. This cannot be stressed too strongly. The more pests and diseases held over through the winter the greater will be the danger of infection during the following year.

This is the time when the orchardist should take careful stock of his failures and successes during the past season so as to profit thereby in the future. Every orchardist should keep some form of record in which all spraying data are regularly entered up, in order that he may be able to amend his programme in the future as experience determines.

MARKETING.

It should be the grower's constant policy to put up a good article and make no attempt to deceive the buyer. Complaints are sometimes made about inspection, but even supposing the Inspector is passed there is still the buyer and consumer. He is the critic and the person who must be pleased in order to create a demand. Given satisfaction, the demand for good sound fruit will increase year by year.

—*I. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

In many citrus-orchards in the Auckland District the autumn blossoming will be considerably in advance of that of previous seasons, and promises to be on the heavy side. Some growers are somewhat neglectful in applying their insecticide for the control of scale insects, thrips, &c. This is a most important undertaking, as no doubt those who have neglected it over a period will have found to their sorrow, for the results are readily shown on the fruits, and much labour is required in washing them before they are marketable. It would be as well for those growers who still have some trouble at this period with sucking-insects generally to apply another spray as early in the coming month as possible. Red oil may be used at 1–40, or, as a substitute, commercial lime-sulphur, 1–35. If the latter is employed it would be as well to use the same compound, at 1–35 or 1–40, for the control of fungoid diseases when the fruit has set.

Those citrus-growers requiring to make an application of chemical fertilizers in the autumn are advised to carry out this work immediately. A well-balanced manure is, of course, essential, but it is as well to point out here that an overdose of nitrogenous matter, especially that which is readily available, is injudicious at this stage. It would only result in a large amount of sappy growth, which would be immediately nipped off should frosty weather occur later.

It is noticed that in some groves—especially the small ones—the lemons are not being harvested as often as they should be. It is not advisable to leave fruit on until it becomes tree-ripe, as this takes considerable nutriment from the tree, and such fruit is generally not of equal commercial value to that taken at the "silver" stage or a little sooner. The size most favoured is $2\frac{3}{8}$ in. to $2\frac{1}{2}$ in., when the fruits may be successfully stored and cured, and, if properly treated, become a good commercial product.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

PRECOCIOUS PULLETS.

The incorrect information so often given that early maturity is an indication of egg-laying power, and that premature laying is the sign of the desirable breeding-bird, has led many poultry-keepers to over-force their pullets with rich foods such as meat, milk, &c., with the result that many of the young birds have commenced to lay at about four and a half months old. This precocity, of course, is very undesirable, because under the conditions mentioned the birds cannot grow into vigorous stock. Further, from a productive point of view they will prove unprofitable, and it is not unlikely that their eggs will never be of a satisfactory size.

Later on such pullets will be undesirable for breeding purposes. Where fowls have been bred to an extreme egg-producing objective generation after generation, the natural inclination to lay is so strongly developed that no forcing methods are needed to make them lay as soon as they have reached the correct productive age. In the

breeding of any class of live-stock it is now recognized that constitutional vigour is the foundation on which success rests, and with the modern high-type layer, upon which there is such an exceptional strain, the possession of outstanding constitution is of special significance. It stands to reason that constitution in a flock will never be maintained by breeding from a bird of a super-laying strain that was brought on to lay before it became fully developed. Of course, precocity should not be confused with the early laying of the well-developed bird; these remarks apply only to pullets which commence to lay when little more than half-grown.

Where it is found that the pullets are making premature development their diet should be changed and a plainer one substituted. In this connection it is a good plan to feed plenty of good plump oats (when the price warrants their use) and an abundance of green food.

SCALY LEG.

Scaly leg is caused by a minute mite which burrows under the scales of the feet and legs of fowls, giving the legs an unsightly appearance. The trouble is most common where fowls are running on sandy ground, or where the quarters are not kept clean. Scaly leg should never be neglected, as it is easily spread from one bird to another. There are several remedies that can be applied to destroy the mites and thereby effect a cure. A few applications of a mixture of equal parts of sulphur and lard, liquefied with kerosene to a consistency of thick oil, will usually prove efficacious. Another proved cure is to dip the affected parts for a few seconds in a mixture of equal parts of kerosene and raw linseed-oil. In each case the legs should be wiped over with a dry cloth after treatment, in order to prevent as far as possible the mixture from getting on the bird's feathers.

LEG-WEAKNESS.

A trouble that may show itself now among the growing stock is a loss of leg-power, although the affected birds may show every indication of being in normal health in all other respects. Cockerels are more subject to this trouble than pullets. Leg-weakness is often confused with rheumatism by poultry-keepers, and in their endeavour to effect a cure they rub the legs with liniments, &c., but seldom or never with the desired effect. There is practically no way of curing this trouble, and prevention is the only feasible way of dealing with it. Leg-weakness is often brought about by overfeeding rich foods such as meat, table scraps, &c., but more frequently it can be traced to insufficient exercise. These influences tend to force the body to a degree that is beyond the strength of the undeveloped legs to carry. On the first sign of leg-weakness all forcing foods should be eliminated from the ration. In addition the birds should be kept busy by compelling them to scratch in deep litter for their grain food, or, better still, by providing a good range under the most natural conditions possible. Free range is essential to healthy development, especially for cockerels that it is intended to breed from. Confinement is necessary in fattening birds for table, but is most undesirable for vigorous and healthy growth.

FLYING-ANTS.

It is safe to say that many fowls die annually as a result of eating flying-ants, yet in the great majority of cases the owners have no idea that these are in any way responsible for the mortality. Several such cases have recently come under my notice. In some instances the birds lost were few, while in others the losses were considerable. The ants make their appearance mostly on a hot sultry day, and, as a rule, just before a shower of rain. They are seen near the sea-coast more frequently than inland, and they usually settle on a sandy area. It would appear that when on the wing they instinctively know when they are nearing the sea, with the result that they fall to the ground, cast their wings, and soon afterwards bury themselves in the sand. In the majority of cases death of the birds soon follows upon their having eaten the ants, while in other cases they may linger for a few days and finally die. Once a bird has eaten these ants little or nothing can be done to save it. The only safe course is to get the birds into the house and confine them there immediately the ants are observed to be on the wing, as it is seldom that the ants find their way to the interior of a house. As an extra precaution it is a good plan to fasten some sacking-material over the open part at the front of the house when the ants are about. (An interesting natural-history note on flying-ants by Mr. W. W. Smith, of New Plymouth, was published in the *Journal* for July, 1921, p. 6.—EDITOR.)

VERMIN AND DISEASE.

Poultry-keepers are often lured into a false sense of security because, having new houses and runs, they go on for several seasons with their stock in a healthy condition. In time they become a trifle careless, failing to realize the importance of keeping the quarters as clean as they should be and the runs fresh and sweet. Then they are suddenly confronted with some infectious disease, and a drastic cure becomes imperative, while stringent means have to be taken to prevent the trouble from spreading. Had preventive measures been in force right from the establishment of the plant the trouble would have been avoided. Although the quarters may be comparatively new it is of the greatest importance that all causes favourable to insect-life and the germs of disease be frequently removed. This implies strict attention to cleanliness, combined with the periodical spraying of disinfectant. In the great majority of houses, however, the spraying against insect-life is not as effective as it should be, as the spraying-material does not reach the crevices and cracks where the insects swarm most thickly. Therefore at the outset it is a good plan to give the whole interior of the houses, as well as all fittings, a good coating of tar. A house well coated with tar can be thoroughly disinfected and disease-germs destroyed, but it is seldom that the interior of an ordinary untarred fowlhouse can be treated with any measure of success.

The run is also a great source of danger to the flock, for the germs of disease and parasitic life may survive in the soil for a considerable time. If these germs are to be destroyed the soil should be periodically turned over, well limed, and sown down with grass, rape, &c. A common mistake made in the laying-out of poultry plants is to have only one run allotted to each poultry-house. The result is that by

constant stocking the run soon becomes poultry-sick, and, having no opportunity of a rest, it provides a harbouring-place for germ-life of all kinds. Moreover, if disease does appear, proper means cannot be resorted to in order to prevent the trouble from spreading. The importance of having two runs for each house and allowing the birds access to them alternately can scarcely be overestimated. No poultry plant is complete unless there is an alternate run to each house. In this way a certain area of ground can be turned over each year, sown down, and allowed to sweeten.

The first thing to do on the appearance of disease is to promptly isolate affected birds, and if the bird is badly affected it should be at once destroyed and the carcase burnt.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

DEALING WITH SUPERS.

ALL extracting-combs should be removed as soon as they are cleaned up by the bees. At this period it is important that the bees be restricted to as small a space as possible. By reducing the size of the hive there is less air-space for the bees to keep warm, and they winter better. It is advisable to leave some supers on the hives where impossible to confine the bees to the brood-chamber. These supers may be dealt with in the spring, when most of the bees will be in one story. A good plan to induce the bees to quickly clean up the wet combs in the supers is to place a mat in which is cut a small hole about 1 in. square between the brood-chamber and super containing the combs. The bees, finding the combs partly cut off by the mat, lose very little time in removing the honey from them. At the time of this operation the excluders should be removed from the hives; they may be cleaned and stored away until required again. Remove all bare combs, taking care not to bend the wires. Zinc excluders are readily cleaned by plunging into boiling water.

FOUL-BROOD.

A strict watch should be kept on the brood-combs for symptoms of foul-brood. In case disease is found in a bad form do not attempt to treat the colony, but destroy it. Very little success will attend treatment at this season, and it is far wiser to postpone it until the spring. Too much caution cannot be exercised in handling infected colonies in the autumn, as robbing is likely to be started and disease spread by the robbers. If the disease occurs in a mild form, take out the infected combs and substitute clean drawn-out combs. Mark all diseased colonies for treatment, and carry out all operations with diseased hives as expeditiously as possible. Tinkering with diseased hives in the off-season is dangerous, as the beekeeper will find to his cost.

CARE OF EXTRACTING-COMBS.

If proper care is not to be exercised in storing the extracting-combs when removed to the honey-house it is far better that they should be stored in the hives. If the latter plan is adopted the mats must be

placed on top of the brood-chamber and the supers tiered above the mats. Unless the apiary is well sheltered, however, they must be weighted, as the winter gales may easily upset them when only empty combs are stored inside. It is far better to remove the combs if it can possibly be done, and thereby obviate the labour of lifting the supers if it becomes necessary to examine the brood-chamber. But in this case the combs must be properly housed to secure them from destruction by mice and wax-moths. It is not uncommon to find tiers of extracting-combs destroyed as the result of carelessness. Mice are especially destructive, and the damage they will do in a short period is such as to render the greatest trouble worth while in preventing them from gaining access to the combs.

During extracting many combs may become damaged, but the damage can be repaired by the bees when the combs are returned to the hives. As a rule, however, mice destroy the combs beyond repair, and no effort on the part of the bees can restore them to their original form. It is during the working season that the beekeeper realizes the value of combs in securing a crop. A shortage of combs during the flow will often prevent the bees being kept in working trim, and the production of honey will be greatly restricted. Mice destroy the combs to gain access to the pollen, and render them foul and offensive to the bees. In the absence of a mouse-proof room the combs can be stacked in supers tiered one above another. Be sure that there are no holes or cracks in the supers through which mice can obtain an entrance. Place a queen-excluder at the bottom of the tier and another on the top. Queen-excluders, if used as described, are a complete success in preventing mice from destroying combs during the off-season.

Should the wax-moth be detected the combs must be fumigated. Bisulphide of carbon is generally used for destroying insect-life, but it should be used with great caution, as it is highly inflammable. It is far better when storing the combs at the end of the season to place a few moth-balls among them. This will usually be sufficient to prevent the attack of the moths.

CARE OF UTENSILS.

As soon as the honey has been disposed of all utensils used in handling the crop should be thoroughly cleaned. Remove all traces of honey from the extractor, tanks, uncapping-knives, &c. Wash carefully with boiling water and dry thoroughly to prevent rusting. The high cost of working equipment should impel the beekeeper to take great care in storing his plant during the off-season. It is advantageous to use loose washing covers of close texture to cover the tanks and extractor. The covers will help to keep the utensils free from dust that is likely to accumulate during the winter. See that all metal parts likely to rust are given a good coating of oil. In season or out of season the watchword of the beekeeper in the extracting-house should be cleanliness.

BOTTOM-BOARDS.

Before finally closing down the hives for winter the bottom-boards will require attention, and may be cleaned by scraping. Usually there is an accumulation of pollen, wax-particles, and dead bees, and,

if left, this material is liable to become mouldy and offensive to the bees. The quickest way is to provide a spare bottom-board; lift the hive on to a spare one, scrape the old board, and replace the hive.

MATS.

It is highly important that every hive should be supplied with one or two good mats during the winter months. Mats keep the bees warm, more especially when gable roofs are adopted, and in case of a late examination having to be made this can more readily be done without disturbing the cluster. Not enough attention is paid to the use of mats, both in winter and summer. They are serviceable in both seasons, and the beekeeper would be saved a great deal of trouble if he could be persuaded to place them in all hives. In winter they keep the bees warm, and in the summer prevent the bees from building combs in the roofs. Neglecting their use altogether when using gable roofs is a constant source of trouble, and leads to unnecessary labour in removing the comb which the bees will have built in the roof. There is no excuse for not using mats, as almost every beekeeper has ample material on hand for making them. Good mats can be made from clean corn-sacks or sugar-bags. They should be cut to exactly fit on top of the frames. A corn-sack will cut up into six mats, and what remains can be used for the smoker. A good plan to adopt in cutting mats is to place a zinc excluder on the material and cut to the same size. Calico mats are useless, providing no warmth and being readily gnawed by the bees.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

In the sheltered beds where spring cabbage and cauliflower plants are being grown at this season aphis, thrips, and caterpillars are doing extensive damage in some localities. This may be checked if the plants are sprayed with a mixture composed of 3 gallons of rain-water and three teaspoonfuls of Black Leaf 40, the latter compound to be diluted and stirred well into half a pint of the water before adding it to the 3 gallons with which it is then mixed; also 2 oz. arsenate of lead with a little water worked into a thin cream before adding it to the bulk. Stir the mixture well, making it up to 4 gallons, and apply as a spray in the early morning or evening, repeating it weekly as required. For early spring cutting these plants (cabbage and cauliflower) and lettuce should be planted out now into land that is warm, well drained, and well prepared.

Seed-beds of main-crop cabbage, cauliflower, and lettuce may be sown down now, also onions—if this has not already been done—the intention being to allow the plants to remain in the beds till about July, when they are usually planted out. In localities sufficiently sheltered peas may be sown for harvesting in early spring.

Continue to earth up celery as it is ready; avoid packing the soil too firm, or the sticks will rot off. Take advantage of any dry fine weather to hoe weeds among growing crops. As soon as land that

is not required immediately for another crop becomes vacant, sow it down in cover-crop to be ploughed in. White mustard matures quickly and has much to recommend it. Oats and horse-beans make good growth during winter months.

The harvesting of crops will still occupy much time. There is a tendency to allow potatoes to remain in the ground after they are mature, but many risks attach to this policy. Far better is it to lift them when the ground is dry, and sort and bag them up daily, main-taining a consistently sound grade. Onions may be ripened [illegible] period field in fine weather, otherwise they are better spread under them until thoroughly dry, when they should be trimmed and sorted. [illegible] often they are kept in a damp, close, dark store; such a plac[illegible] the quite unsuitable. A light, dry, well-ventilated shed is necessary to keep them in good condition.

Tomato-vines, as soon as the crop is gathered, should be dug, and, when dry, gathered and carefully burned. Unless another crop is to follow immediately, broadcast a cover-crop and harrow the seed in. The time for sowing the next tomato crop is not far away, and soil will then be required for seed and plant boxes. A good, clean, sweet, friable mixture will be required if the plants are to be grown satisfactorily. This cannot be compounded at the last moment. Most of our troubles with young plants are owing to an endeavour being made to do so. The compost heap should be already mixed for this purpose; if not, it should be got together without delay.

STRAWBERRY-PLANTING.

The strawberry is a hardy plant, preferring a heavy well-drained loam in a district with a good rainfall. On clean, well-prepared land it may be planted now. It is customary in most localities to make a liberal dressing of blood-and-bone manure just before the last ploughing. The greatest care is necessary to obtain good plants of a variety proved suitable to the district. Plant securely on a firm even surface as soon as the plants can be obtained.

TOBACCO.

With the colder days now being experienced the tobacco crop will want closer supervision, specially if the season be wet. At such times mould fungus is likely to develop and seriously depreciate the quality of the leaf. In extreme cases it may be necessary to dry the atmosphere of the store by means of charcoal fires or setting up a stove heater for a time. This should be done with due caution, remembering that when dry the leaf is very inflammable.

HERBACEOUS PLANTS.

Preparations for the planting season should now be well forward. Most plants of the herbaceous class may be dealt with at once. Such plants in nature do not remain and flourish long in one position, and in gardens four years or thereabouts is the period of their usefulness. They have then to be lifted, the land reconditioned, and the plants broken up and replanted. Better still is it to recast the scheme of planting so that both the plants and the land enjoy a change.

PERSIMMONS, FIGS, LOQUATS, AND NUTS.

Many kinds of fruit and nuts deserve more attention from the planter. The persimmon, a native of northern China, where it is grown extensively, has done well almost wherever it has been planted in this country. Too often an unsuitable variety has been chosen, but such varieties as Tsuro-gaki and Tamopan are of high quality, and the fruit is said to keep well in cool storage.

On the better class of soils with good drainage figs and loquats [illegible] well receive more attention. In this instance, also, growers [illegible] been disappointed with seedlings and inferior varieties—experiences, however, that are almost unavoidable for the pioneer. While the Smyrna class of figs is unsurpassed for richness of flavour, they require the assistance of the little *Blastophaga* wasp to enable them to set their crop—an insect that has not yet been successfully introduced into this country. Perhaps nearly as important commercially, however, are White Adriatic and Mission (California Black) varieties, which do not require the assistance above mentioned. The bold foliage of the loquat-tree is a familiar sight in many gardens, but very rarely is a good fruiting variety met with. Named varieties, with fruit of large size and good quality, are now listed by nurserymen. These are worth a trial in good soil and warm localities.

The price of edible nuts warrants further planting. Walnuts, chestnuts, and hazels crop well in this country; it only remains to secure satisfactory varieties, which, in the case of the first two, must be properly worked on seedling stocks. The hazels and filberts are more often propagated by layering.

—*W. C. Hyde, Horticulturist.*

Investigation of Irrigation in America.—On 3rd March Mr. C. J. McKenzie, Public Works Department, together with Messrs. R. B. Tennent and J. R. Marks, writers of the series of articles on "Irrigation and its Practice," concluded in last month's *Journal*, left Wellington for California and Canada on an official mission of inquiry into irrigation in those territories. The subject will be studied from engineering, agricultural, marketing, administrative, and financial points of view. Messrs. Tennent and Marks will return to New Zealand in about four months; Mr. McKenzie proceeds to Europe from America on other engineering business.

Rabbit-control in Harapepe District.—Regulations under the Rabbit Nuisance Amendment Act, 1920, were gazetted on 19th February, the effect of which is to suspend trapping in the Harapepe Rabbit District (South Auckland) except by permission and under conditions specified by the Board.

London Market for Peas and Beans.—The following advice was cabled by the High Commissioner on 7th March: *Peas*—Market slow. Japanese parcels which have arrived sold at £23 12s. 6d. per ton; March–April shipments, £23 15s. Stocks of New Zealand and Tasmanian Partridge heavy and demand poor; nominal values are—New Zealand 65s. to 70s., Tasmanian 75s. to 78s., per 504 lb. ex store; English best quoted at 51s., inferior down to 42s. *Beans*—English in large supply and demand slow; quoted at 46s. to 51s. per 532 lb. Chinese horse-beans, new crop, July–September shipment, offered at £10 2s. 6d. per ton without finding buyers.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PIGS INFECTED WITH SOIL ORGANISM.

J. D., Te Poi :—

I have some twenty pigs, varying in size from slips to young porkers, running on pasture and getting all the skim-milk they can drink, the milk being always fed sour and from twelve to twenty-four hours old; condition of huts, &c., clean. Occasionally one or more of the pigs will break out into what appears to be ordinary boils, generally on the face but sometimes on a leg. These come up to a head, burst, and then quickly heal, just as a boil does on a human being. Should the affected pigs be isolated, and would medicine or a change of diet be beneficial? All the pigs are fat and apparently full of health and vigour.

The Live-stock Division :—

The trouble is apparently due to infection with a soil organism — *Bacillus necrosis*. This arises in the first instance through inoculation of some scratch or sore on the skin; the discharge from the swelling which forms later may be infectious. In the circumstances, as the ground is infected, it is advisable to remove non-affected pigs from this place to clean sties, keeping the affected animals there until they are disposed of. Cleanliness and frequent disinfection of the sties must be observed in dealing with the trouble. The sores on affected pigs can be painted once or twice with tincture of iodine as an antiseptic measure.

FOOT-TROUBLE IN SHEEP.

J. C., Eiffelton :—

My land is of a swampy nature and the pasture grows very rank. I always run crossbred sheep, but find difficulty in keeping their feet sound. After a line of sheep has been grazed at this time of the year and on through the winter, in about six to eight weeks a little fester or gathering starts at the top of the hoof between the toes. Could you recommend any preventive or cure for this trouble?

The Live-stock Division :—

Swampy land frequently gives rise to either foot-rot or scalding between the toes of sheep. Long rank grasses irritate the softer structures between the toes, including the small duct (opening), which becomes covered over with dirt, &c., with consequent growth of bacteria and pus formation. Prevention would necessitate draining the swamp, which in your case may be impracticable. Treatment consists of cleansing the part and removing any foreign bodies. If only a few sheep are affected the parts may be painted with tincture of iodine, using a stiff brush for the purpose. Where large numbers of sheep are affected the use of a race is advisable. In this race should be placed a trough containing a 5-per-cent. solution of bluestone (copper sulphate), ½ lb. to gallon of water, and through this the sheep should be slowly driven. Arsenic may also be used, but owing to its poisonous nature its use is not recommended. A paste made of one part bluestone, one part lard, and two parts of tar, carefully mixed over a slow fire, is also useful where only a few sheep are to be treated.

DESTROYING WILLOWS IN A STREAM.

K. L. BEDLINGTON, Otorohanga :—

Could you inform me as to the best method for destroying willows in a stream?

The Horticulture Division :—

The best method of destroying willows in a stream depends on circumstances, concerning which you say nothing in this case. One method is to impregnate the trees at this season with commercial sulphuric acid or any good weed-killer. The acid is introduced by means of auger-holes made low down in the butts.

HORSE LICKING THE GROUND.

E. T. DEAN, Puhipuhi :—

Could you advise treatment of a horse, age about six years, that is constantly trying to eat soil? The animal was in very poor condition last winter, but is fair now. She usually starts licking the ground when left standing with harness on.

The Live-stock Division :—

The symptoms indicate the animal to be suffering from a form of gastric indigestion with acidity. If possible, a change of pasture should be given. The following powder given once daily, mixed in a bran mash and continued for a fortnight, should prove beneficial: Bicarbonate of soda, ½ oz.; gentian, ½ oz. You should also place a lump of rock salt in a convenient place for the animal to lick.

CONTROL OF PENNYROYAL.

W. J. C., Kairanga :—

Please give me directions for destroying pennyroyal in pastoral land.

The Live-stock Division (Noxious-weeds Inspection) :—

Pennyroyal (*Mantha pulegium*), which is a perennial, and which thrives especially on heavy, damp land—more especially sour land—is somewhat difficult to eradicate by cutting, grubbing out, pulling up, and suchlike methods. Where the land is ploughable it is more easily dealt with, as it can be worked out through a succession of crops. In 1917 a number of experiments for the control of pennyroyal were carried out at Awahuri, the net results of which were, in effect, that pennyroyal thrives best in wet, sour land (though it also grows fairly well on all classes of land), and to get rid of it wet places must be drained and steps taken to sweeten the land by liming and general cultivation. It was also demonstrated to be good practice to sow two good smother-crops, such as rape and green oats, before sowing down to pasture. Patches of pennyroyal showing in the new pasture may be killed by spraying with an arsenic and soda mixture, made up as follows: 1 lb. arsenic, 1 lb. caustic soda, 20 gallons water; the arsenic and soda to be boiled in 1 gallon of water until all ingredients are dissolved, and the balance of the water added before use. To clear this weed from unploughable land the same spray may be used. A heavy dressing of salt (1 to 2 tons per acre) and most of the proprietary weed-destroyers will also kill pennyroyal, but the arsenic preparation has been found the cheapest. As the arsenic spray is poisonous, stock must be kept off the pasture until after a good rain. The arsenic spray is detrimental to clovers, but appears to have no ill effect on grasses. Salt is detrimental to both grass and clover, but probably would have a stimulating effect on next season's growth of the pasture.

MARE FAILING TO BREED.

"CLYDESDALE." Hakaru :—

I have a good type of farm mare, sixteen or seventeen years old, which has failed to breed recently. She had two foals in succession, but last year and this year failed to get in foal again. She was washed out with Lysol just before coming in season and just before putting her to the horse for the second time this year—quantity about one and a half teaspoonfuls to a quart of warm water. Can you advise me in the matter, as I am very anxious to breed from her. If you recommend irrigation, will you state when to do it—either now or next season when I put her to the horse again, and whether it is to be done when she is in season or just before? I have noticed her throwing out white matter when in season. She failed to breed to an old horse last year, so was put to a two-year-old draught this year, and is about the only failure.

The Live-stock Division :—

The symptom of a muco-purulent discharge at the period of heat points to the mare being affected with a catarrhal condition of the womb. This is seen occasionally in old mares, and is usually the cause of permanent sterility. The

infection probably dates from the last foaling. On account of the age of the mare, treatment is not likely to be successful. However, irrigation of the womb might be tried when she is in season. For this purpose a solution made by adding 2 oz. of Lugol's solution of iodine to 5 pints of water should be used as a douche. This is to be carried out daily for two or three days. It is not advisable to irrigate before service with an antiseptic solution, but as acidity of the genital passage is frequently present in such cases it is often found beneficial to wash out with an alkaline solution ; 4 oz. of baking-soda dissolved in a gallon of water, used as a douche one hour before service, answers this purpose. Improvement in the mare's condition by an extra allowance of nourishing food is essential.

OVERGROWN HOOF IN COW.

S. DENNIS, Glenroy :—

I have a cow that has a hoof which is overgrown in length and is inclined to crack more or less. This animal seems to be in pain, and has not done well for a long time. What is the best thing to do for it ?

The Live-stock Division :—

The overgrowing of claws in cattle is very common where animals are grazed on soft land. The part of the claw which is overgrown may be removed, there being a special instrument for the purpose ; but, failing this, a pair of strong pruning-shears may be used. The cow must be fixed in a position so that the foot affected is easily manipulated, and the leg fixed by a leg-rope to prevent kicking. A portion of the horn is severed from the end of the claw with the shears, care being taken that the claw is not severed too far back or the sensitive tissues will be injured. Another method is to use a piece of board, a broad chisel, and a mallet. The board is placed under the claw, and the chisel where it is intended to cut off some of the horn. With a sharp blow from the mallet the claws can be severed. The only difficulties are the kicking of the cow and the possibility of cutting the claw too far back and severing the sensitive structures. The pain suffered by your cow is the result of the excessive strain, as also is the cracking, and it should ease on the removal of the growth of horn.

WEATHER RECORDS: FEBRUARY, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

IN the early part of February the weather was generally mild, warm, and fine, though showery conditions were experienced at times north of Auckland, with light east to south-east winds. On the 14th a prolonged spell of westerly weather set in and caused unsettled conditions until the 24th. During this period stormy weather was prevalent in different parts at different times. Thus on the 14th the winds rose and heavy rain followed in the North ; on the night of the 16th there was a heavy thunderstorm and deluge of rain for a short time about Dunedin ; on the night of the 17th and morning of the 18th hard north-west gales did considerable damage in the Wairarapa and Wellington districts ; and from the 21st to the 23rd the weather was very boisterous, especially about Cook Strait and in Westland and Canterbury.

The month's total rainfall was above the average on all the western coast and in the high country of the South, 28·88 in. being recorded at Arthur's Pass. On the east coast of both Islands, however, the rainfall was below the mean ; for example, at Napier 0·72 in. fell, which is 72 per cent. below the mean ; and at Christchurch 0·27 in. for the month, which is 84 per cent. less than the mean of former years.

A remarkable feature in Canterbury was the heavy rain in the high back country, which caused the rivers to flood, though the weather was dry on the plains, and the Waimakariri broke through its banks on the night of the 23rd.

—*D. C. Bates, Director.*

RAINFALL FOR FEBRUARY, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	3·13	6	1·50	2·95
Russell	2·64	9	1·10	4·35
Whangarei	2·86	12	1·72	4·95
Auckland	3·37	14	1·32	3·02
Hamilton	3·10	13	1·02	2·85
Kawhia	3·91	12	1·46	2·40
New Plymouth	2·91	11	0·77	4·09
Inglewood (Riversdale)	6·97	13	2·00	6·30
Whangamomona	4·43	11	1·86	4·14
Tairua, Thames	2·10	8	1·15	4·52
Tauranga	2·54	10	1·10	3·73
Maraehako Station, Opotiki	2·78	13	1·60	3·70
Gisborne	2·21	10	1·01	3·68
Taupo	3·00	8	1·04	2·81
Napier	0·72	8	0·44	2·56
Maraekakaho Station, Hastings	1·00	6	0·80	2·52
Taihape	1·41	13	0·29	2·43
Masterton	1·58	10	0·37	2·71
Patea	3·29	11	0·60	2·33
Wanganui	1·56	5	0·53	2·49
Foxton	1·98	6	0·42	1·71
Wellington	3·90	10	1·14	3·18
South Island.				
Westport	5·00	16	1·98	4·37
Greymouth	8·80	15	1·71	6·13
Hokitika	11·23	17	2·87	7·20
Arthur's Pass	28·88	14	7·50	7·55
Okuru, Westland	17·42	15	2·94	7·92
Collingwood	9·14	14	3·36	5·63
Nelson	3·49	13	1·09	2·80
Spring Creek, Blenheim	2·65	9	0·84	2·30
Tophouse	7·30	19	1·41	4·50
Hanmer Springs	3·73	14	0·81	2·93
Highfield, Waiau	1·42	7	0·50	2·59
Gore Bay	0·96	4	0·55	3·50
Christchurch	0·27	8	0·12	1·84
Timaru	1·56	15	0·28	1·89
Lambrook Station, Fairlie	0·80	6	0·44	1·95
Benmore Station, Omarama	2·25	9	0·70	1·23
Oamaru	0·68	9	0·22	1·72
Queenstown	5·50	12	1·57	1·76
Clyde	1·16	7	0·30	0·99
Dunedin	2·22	13	0·72	2·69
Gore	..	..	..	2·47
Invercargill	2·82	21	0·66	2·68

FORTHCOMING AGRICULTURAL SHOWS.

Methven A. and P. Association : Methven, 26th March.
Katikati A. and P. Society : Katikati, 26th March.
Temuka and Geraldine A. and P. Association : Winchester, 2nd April.
Malvern A. and P. Association : Sheffield, 16th April.
Flaxbourne A. and P. Association : Ward, 22nd April.

FRUIT-TREE GRADING REGULATIONS.

THE regulations of 1921 governing the grading of fruit-trees for sale from nurseries were recently revoked, and the following regulations made in their place :—

1. In these regulations, if not inconsistent with the context,—

"Diameter" means the diameter of a fruit-tree measured 2 in. above the union :

"Fruit-tree" means any variety of apple, pear, apricot, peach, or nectarine tree :

"Nursery" means any land which is used for the raising or growing of any fruit-trees, if such fruit-trees or any of them are intended for sale for replanting :

"Sale" or "sell" includes barter, and also includes offering or attempting to sell or exposing for sale, or sending or delivering for sale, or causing or allowing to be sold, offered, or exposed for sale :

"Sub-package" means one of two or more packages enclosed in one cover.

2. (1.) On every sale of fruit-trees from a nursery, whether direct or through an agent, there shall be issued, by or on behalf of the occupier of such nursery to the purchaser or intending purchaser, a statement of the grade of such fruit-trees determined as hereinafter set out ; provided that nothing in these regulations shall apply to the sale of fruit-trees in the execution of an order for not more than fifty trees or to the sale of lots of not more than ten trees of any one variety. (2.) Such statement as to grade shall be set out in the invoice, also on a tag or label attached to each package of fruit-trees. (3.) It shall not be lawful to pack trees of different grades together unless the trees constituting each grade form a distinct sub-package ; each such sub-package shall bear a tag or label in accordance with the requirements of the last preceding subclause.

3. The grading of fruit-trees from a nursery shall be done by or on behalf of the occupier of such nursery prior to the sale of such fruit-trees.

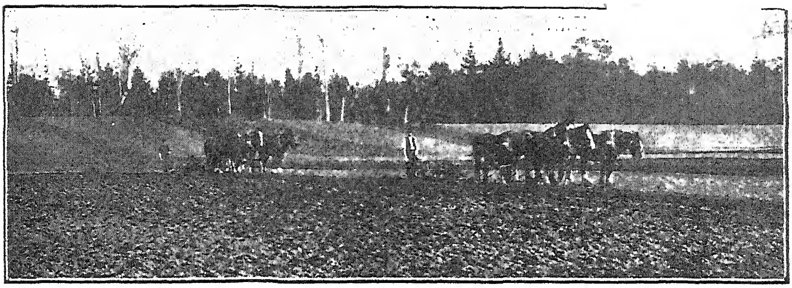
4. The following are the standards by which the grade of apple or pear trees shall be determined : (1.) "A (or commercial) grade" shall consist of trees the diameter of which is not less than $\frac{7}{16}$ in. nor more than $\frac{10}{16}$ in. : Provided that trees which are more than $\frac{10}{16}$ in. in diameter may be included in this grade if such trees are not more than one year from the bud or graft : Provided further that in the case of the following varieties of pear-trees—viz., Winter Nelis, P. Barry, Marie Louise, and Josephine de Malines—trees may be included in this grade the diameter of which is not less than $\frac{6}{16}$ in. "B (or nursery grade)" shall, subject to the last preceding proviso, consist of trees the diameter of which is less than $\frac{7}{16}$ in. "C (or special) grade" shall, subject to the first proviso in the case of A grade, consist of trees the diameter of which is more than $\frac{10}{16}$ in. (2.) Apple or pear trees of all grades shall be well rooted, and, if branched, shall be of fair shape, and shall have not less than three branches averaging 18 in. in length.

5. The following are the standards by which the grade of apricot, peach, and nectarine trees shall be determined : (1.) "Commercial grade" shall consist of trees the diameter of which is not less than $\frac{8}{16}$ in. "Nursery grade" shall consist of trees the diameter of which is less than $\frac{8}{16}$ in. (2.) Apricot, peach, and nectarine trees of commercial grade shall be well rooted and branched, and of fair shape.

6. In the grading of fruit-trees there shall be allowed a margin of error ; provided that in any one consignment of fruit-trees forwarded from a nursery to a purchaser the margin of error shall not exceed 5 per cent. by number ; and provided further that where the error relates to the diameter of the trees no greater margin than $\frac{1}{16}$ in. shall be allowed.

7. If any purchaser of fruit-trees from a nursery is dissatisfied as to the grading of such trees he may make complaint to an Inspector, but such complaint must be made within fourteen days of the receipt of such trees by the purchaser.

8. Every occupier of a nursery who (*a*) sells any ungraded fruit-trees from such nursery, or (*b*) sells any fruit-trees from such nursery without issuing to the purchaser a statement of the grade assigned to them, or (*c*) sells any fruit-trees from such nursery which are incorrectly graded, commits an offence against these regulations, and shall be liable on conviction to a fine not exceeding £20.



The New Zealand

Journal of Agriculture.

VOL. XXX.—No. 4.

WELLINGTON, 20TH APRIL, 1925.

BREEDING OF ROMNEY-CROSS SHEEP.

WOOL-IMPROVEMENT DEMONSTRATION AT WALLACEVILLE.

J. G. COOK, Wool Instructor, Live-stock Division.

IN view of recent statements by the Bradford trade alleging deterioration in New Zealand Romney-cross wool—chiefly as regards increasing hairiness or medullation of fibre—it will be of interest to sheep-farmers to record the practical breeding operations carried out by the Department of Agriculture with a small ewe flock at the Wallaceville Veterinary Laboratory Farm, near Wellington, during the past five years. The work, it will be noted, was commenced well before the Bradford criticisms in question made themselves heard. Without entering into this particular controversy on one side or the other, it may be claimed that the Wallaceville results have provided a valuable demonstration of what can be accomplished in wool-improvement by any farmer within a comparatively short period. It has been shown that Romney-cross wool can be readily bred with a high degree of purity of fibre—in fact, that this, our predominant crossbred-wool product, is not inherently or necessarily defective as regards its internal structure.

RECORD OF WALLACEVILLE FARM FLOCK, 1920 TO 1924.

The ewe flock in 1920 was a mixed one of both Lincoln-Romney and Romney-Lincoln cross. The ewes were a fairly good line as regards constitution, but there were many defects in conformation, such as overlong faces, narrowness between the eyes, legginess, and lightness and roundness in the bone. The wool grown by the flock, which ranged

from 36's to 40's in spinning count, was of a very inferior quality. It was what is termed hairy, most of the fibres being medullated; pure kemps were also to be found in some of the fleeces. Moreover, the wool was too open for proper resistance to adverse climatic influences, with resultant unevenness of diameter in the fibres throughout their length. On looking over the line one would be doubtful as to there being any really pure wool in any of the fleeces, and this was confirmed by microscopical examination.

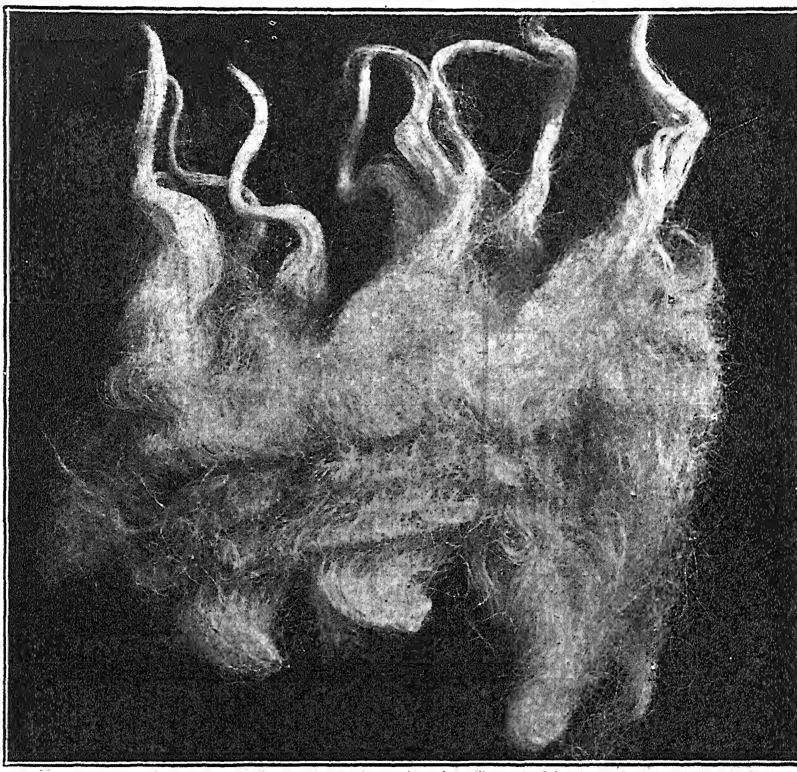


FIG. 1. SAMPLE OF WOOL FROM THE ORIGINAL EWE FLOCK AT WALLACEVILLE LABORATORY FARM; 1920–21 SHEARING.

Year 1920.—In this year the flock was divided, half being mated to a Southdown ram and half to a Romney. The Romney ram (No. 1) was an animal of sound constitution. In conformation he had a well-shaped head, good width between the eyes, face a nice length, and good neck, shoulders, and hind quarters, together with strong, flat bone. The wool grown by this ram was what is termed strong—that is, about the coarsest quality of its breed, 40's to 44's—with a fair amount of character in it. With but few exceptions the resulting crop of lambs from this mating showed a noticeable improvement in

the quality, character, and density of the wool. There was also a general improvement in the conformation of the lambs as compared with their dams. All the ewe lambs were kept, and were shorn when hoggets at the latter end of 1921. Any of those that had thrown back too much to their dams were culled out at this time, the fleeces taken off them being an excellent guide for this purpose. A microscopical examination of several samples of this line of hogget wool proved very clearly that good progress had been made by eliminating

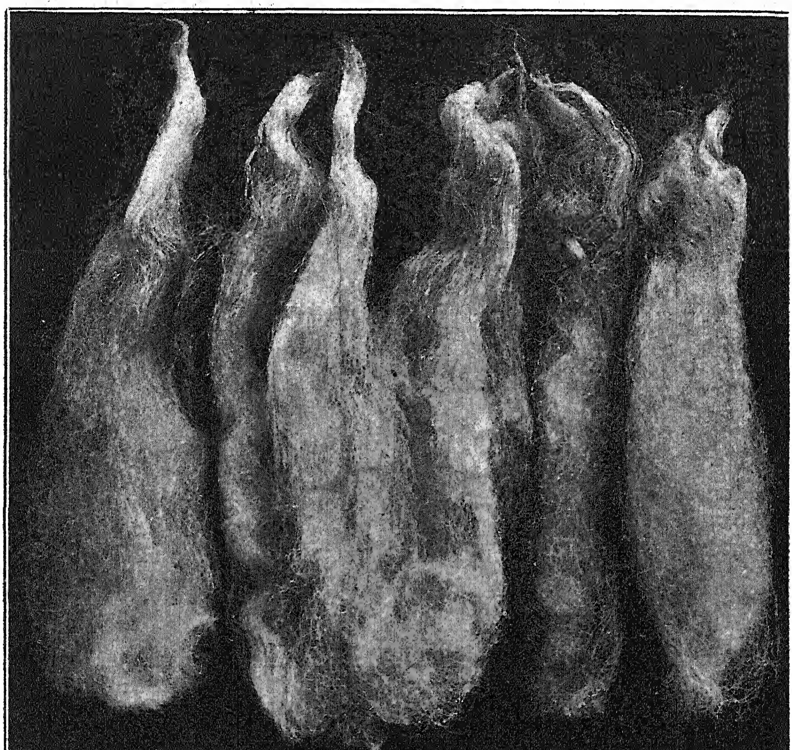


FIG. 2. WOOL FROM THROWBACKS AMONG PROGENY OF THE STRONG-WOOLLED ROMNEY RAM (NO. 1) AND THE ORIGINAL EWES; 1921–22 SHEARING.

a large proportion of the hairy element that had been present in the dams' fleeces. The wool consisted largely of what is termed broken medullated fibres, thus giving a strong indication that if these hoggets were mated with a fine-woolled Romney ram their progeny would grow a very high proportion of pure wool.

Year 1921.—The strong-woolled Romney ram (No. 1) was mated with the same ewes in 1921, and a similar result was apparent in the crop of lambs from this mating. A few of the coarsest of the ewe

lambs were culled out, but the bulk were kept, and were shorn as hoggets in 1922. An examination of the fleeces showed the same results as in the previous line of hoggets, which was only to be expected as the animals were full sisters. On the farm we now had two lines of ewes by the same ram out of the same ewes.

Year 1922.—The strong-woolled ram was now replaced by a fine-woolled Romney (No. 2). Many of the oldest ewes had been culled out and sold about this time. The new ram was of splendid constitution, and possessed good conformation—neck well set, shoulders

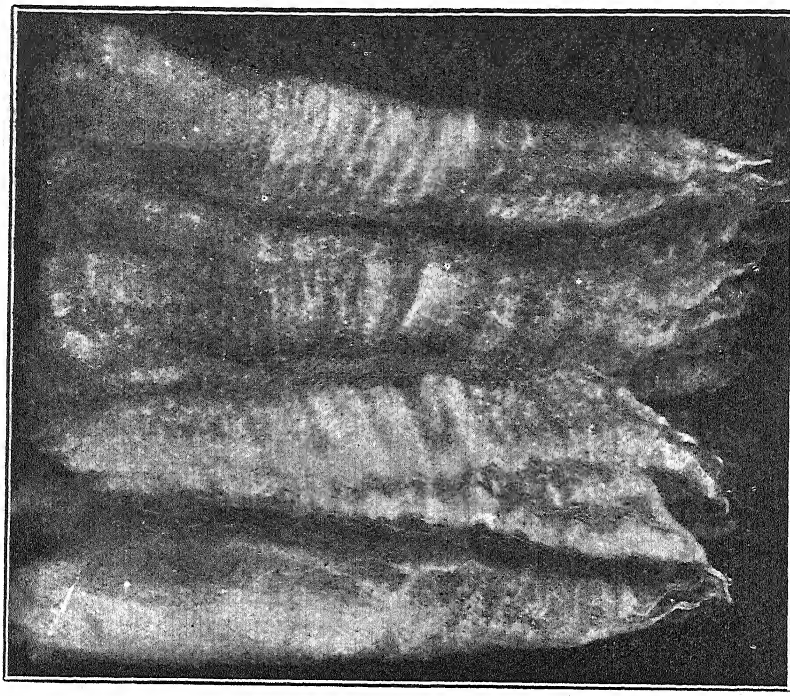


FIG. 3. WOOL FROM HOGGETS, PROGENY OF THE STRONG-WOOLLED ROMNEY RAM (NO. 1) AND THE ORIGINAL EWES; 1921–22 SHEARING.

level and set forward, level back, good loin and hind quarters, well-shaped head, breadth between the eyes, and face a nice length. The wool grown by this ram was very even in quality—46's to 48's—and had considerable character. It also possessed a fair degree of density—a most desirable feature. He was, in fact, a very good all-round animal, and it is a pity he could not have been used on a larger place.

This ram was mated with the ewes on the farm, including the ewe hoggets lambed in 1920 and shorn in latter part of 1921. The crop of lambs from the mating was very good, showing a decided improvement in both conformation and wool. All the ewe lambs were kept

on the farm, and were closely examined when they were brought in for shearing in 1923. Only two were culled out on account of wool-defects throwing back to the original line of ewes in 1920. This hogget wool showed the great improvement that had taken place by using ram No. 2. The wool was more even in quality; it had a higher spinning count; also greatly increased density (number of fibres per given area of skin); the yolk was carried out to the tip, giving strength to the fibre (thus enabling it to undergo the combing process with very little loss in noil). There was also increased character, making it a more

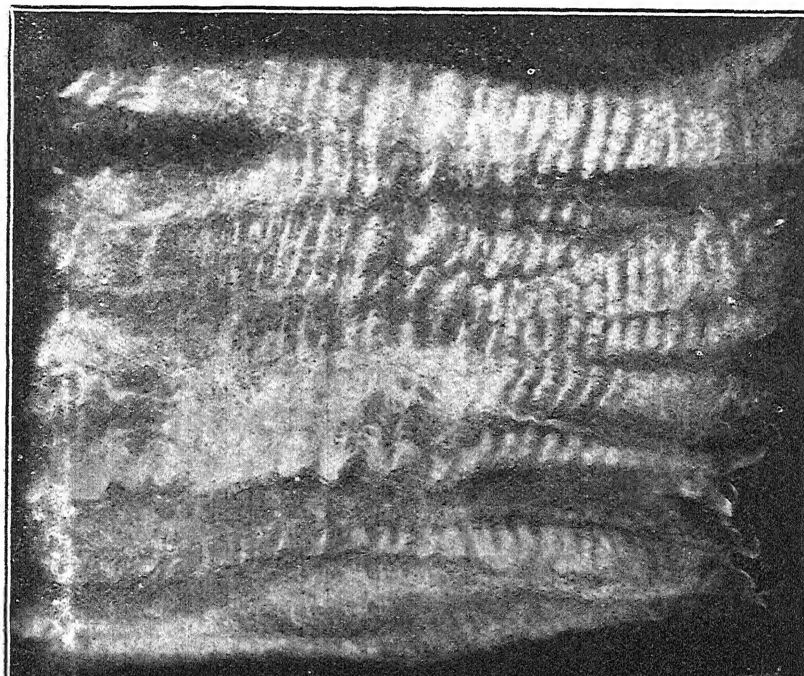


FIG. 4. WOOL FROM HOGGETS, PROGENY OF THE FINE-WOOLLED ROMNEY RAM (NO. 2) AND THE FIRST-CROSS EWES; 1923–24 SHEARING.

First-cross ewes were by ram No. 1 out of original ewes.

elastic, pliable, and soft handling wool (thereby enabling a high class of material to be made from it). A microscopical examination of samples taken from each fleece showed very clearly the great difference between the wool of these hoggets and samples taken from their grand-dams. A few of the fibres in some of the samples still showed slight medullation, but this was broken or patchy, the other parts of the fibre being pure wool. In several of the samples all the fibres were pure wool. The scaling on the fibres and the evenness of diameter throughout their length were also very satisfactory.

Year 1923.—In this year ram No. 2 was mated with the same ewes as in 1922, and also had for service the ewes from the 1921 lambing. The lambs produced from this mating were again very good. The ewe lambs were kept and shorn as hoggets at the end of 1924. The wool was excellent to the eye and touch. Samples were taken out of each fleece, and a microscopical examination showed the same good results as in the 1923 hogget wool. This was to be expected, the two lots being full sisters.

Year 1924.—For the mating season of 1924 another Romney ram (No. 3) was secured. He was lacking a little in conformation, and although he could be classed as a fine-woolled Romney his wool did not have the same degree of character in it, nor the density, that characterized

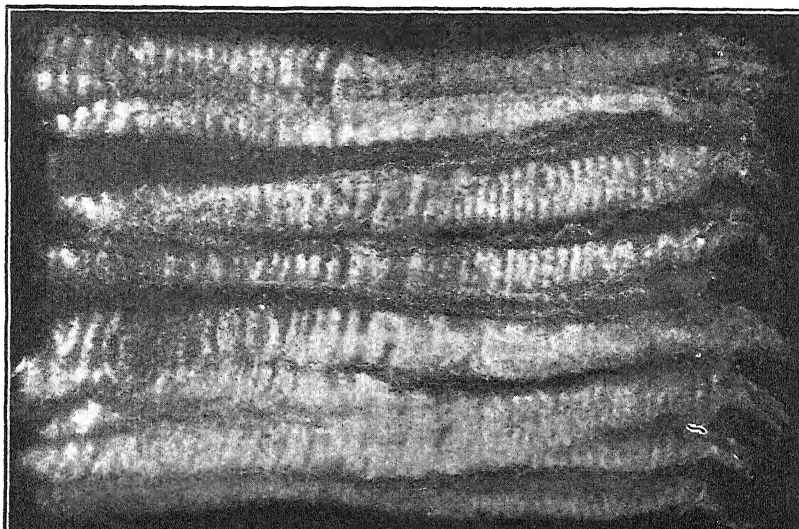


FIG. 5. WOOL FROM HOGGETS, PROGENY OF THE FINE-WOOLLED RAM (NO. 2) AND THE FIRST-CROSS EWES; 1924–25 SHEARING.

[*All photos by H. Drake.*

the fleece of ram No. 2. These deficiencies are certain to be shown in his progeny, and will be watched for very closely at the 1925 shearing for future guidance.

It may be recorded that the hoggets of 1924 averaged the very satisfactory fleece weight of $11\frac{1}{4}$ lb. at shearing.

Summary.—In 1920 the farm had a line of ewes growing a very inferior wool, rightly termed "hairy." These ewes were mated with a strong-woolled Romney ram (No. 1) for two years in succession. This ram was then disposed of, and some of the oldest original ewes were sold off. In 1922 a fine-woolled Romney ram (No. 2) was brought to the farm and mated with the remainder of the original ewes and ewes from the first mating of ram No. 1. In 1923 more of the original line

of ewes were sold, and ram No. 2 was mated with any that were left, also with the two lots of ewes produced by the mating of ram No. 1 with the original ewes. In 1924 another fine-woolled Romney ram (No. 3) was procured and mated with the flock, in which were included both lots of ewes sired by ram No. 1 and lambed in 1920 and 1921 respectively. Ram No. 3 was also mated with the first lot of ewes by No. 2 ram, lambed in 1922.

GENERAL.

The prices paid for the different rams here referred to were: No. 1, £15; No. 2, £8; and No. 3, £8 8s. Such prices are within reach of any sheep-farmer who desires to effect an improvement in his wool-clip.

For the current (1925) season a fine- and dense-woolled Romney ram has been purchased at a price of £12 12s. He is being mated with the ewes from the 1922 and 1923 crossings and a few ewes of previous matings. Results will continue to be watched and records taken.

The maxim that "The ram is more than half the flock" has been fully borne out in the results of the breeding conducted at Wallaceville. A sound, practical demonstration has been given of the great improvement that can be effected by using good rams and culling out the most defective ewes in the flock. The covering grown by the ewes in the past has been brought from medullated fibres, with kemp among the fleece, up to the present fleece, in which there is practically no kemp, and the greater proportion of the fibres are pure wool—in some of the samples every fibre being pure. It has been clearly shown that Romney crossbred sheep in New Zealand will grow as much pure wool as any other breed or cross.

It may be added that the dual-purpose feature of the Romney breed—meat as well as wool—has not been lost sight of in the breeding operations here recorded. The wether lambs from the several matings have been regularly sold as high-grade fat stock.

Sheep-farmers visiting Wellington and interested in this matter will be welcome to inspect samples of the wool referred to at the Live-stock Division headquarters, Dominion Farmers' Institute Building.

Shipment of Green Cheese.—In the course of a recent address on the cheese trade to the Dairymen's Association of Western Ontario Dr. J. A. Ruddick concluded his remarks regarding the shipping of green cheese as follows: "Before we leave this matter I should like to refer once more to the foresight and precautions taken by our chief competitors, the New-Zealanders. Although New Zealand cheese, even if shipped direct from the hoop, is nearly three months old before it can reach the consumer, the New-Zealanders have taken the precaution to legislate that no cheese shall be offered for grading until it is fourteen days old. A person who knows the conditions in both countries is sure to be struck by the fact that while in Canada we seem to be possessed of a desire to market our cheese at the earliest possible moment, in New Zealand a matter of a week or a month's delay is scarcely taken into account. I think the New-Zealander realizes that delay very often means improvement in quality, and that, so far as the market is concerned, it is just as likely to be favourable at one time as another. There are no recognized periods now when prices are likely to advance as there used to be in the old days with its off season of production."

THE PEAR-MIDGE.

FURTHER OBSERVATIONS AND CONTROL WITH CALCIUM CYANIDE.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

THE original account of the pear-midge (*Perrisia pyri*) in New Zealand—published in this *Journal* for August, 1921—dealt with the life and seasonal histories of the insect, and results of control experiments carried out at that time. In the following pages the position is reviewed from the first appearance of the midge in the Dominion to the present time, and the results of control experiments with calcium cyanide are discussed.

A feature in the midge-infested areas near Auckland, where the pear-trees have been subjected to severe infestation for the past four or five years, is that the trees are stunted, and the leaves which do develop are dwarfed, while their green colour has assumed a fairly yellowish tint.

SPREAD OF THE MIDGE.

Auckland: The initial outbreak of pear-midge in New Zealand occurred in the spring of 1916 at Avondale, near Auckland (area 1 on map). From there it rapidly spread during the succeeding years to adjoining districts, and by the 1920–21 season had become established over Eden County and southern part of Waitemata County (area 2, shaded), as well as in the Waikato (area 6). In the following season it appeared northward at Huapai (area 3) and Komiti (area 4), and southward at Te Kauwhata (area 5).

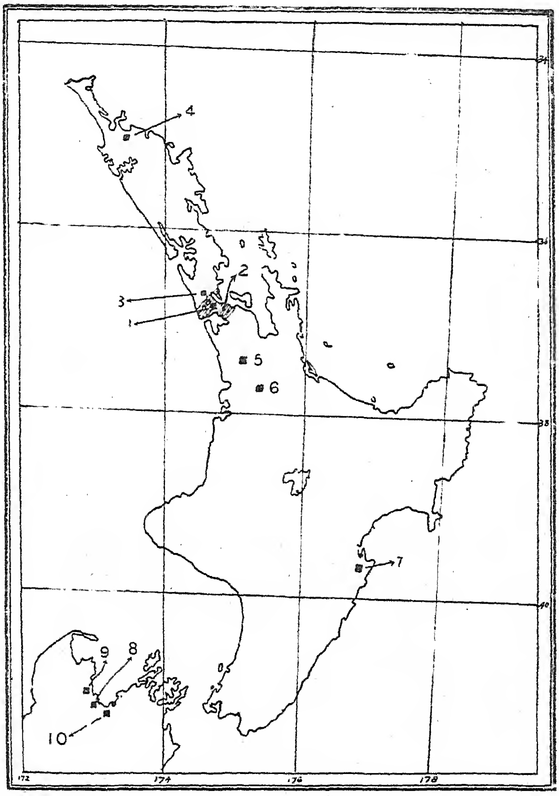
Hawke's Bay: At Hastings (area 7) the midge appeared during the spring of 1920, infesting a block of orchards eastwards of the railway.

Nelson: The midge made its first appearance in the South Island in an orchard at Tasman (area 8) during the spring of 1921, and spread from there to adjoining areas, as well as attacking orchards separated from the originally infested one by low ridges. Shortly after this the midge was reported westward at Riwaka (area 9), while not until last spring (1924) did it appear to the west in the orchards in the Redwood's Valley and Stoke districts (area 10).

A consideration of these midge-infested districts shows that they lie in at least five naturally isolated areas: Waitemata and Eden Counties (1, 2, and 3), Komiti (4), Waikato (5 and 6), Hawke's Bay (7), and Nelson (8, 9, and 10). The natural barriers are distance, air-currents, sea, or mountain-ranges. The absence of pear-orchards over given areas is also an isolating factor.

Two factors have been responsible for the spread of the midge from its initial point of establishment at Avondale to the other districts recorded above. These factors are (1) natural dispersion by the flight of the insect aided in many cases by wind, and (2) artificial dispersion in the larval and pupal stages in soil surrounding roots of nursery stock.

Natural dispersion was no doubt the chief means by which the areas in the vicinity of Auckland City became infested, though the movement of nursery stock played some part, particularly in the infestation of an area such as at Huapai, which is partially isolated by low hill country. The establishment of the midge in the other districts enumerated can be accounted for only by artificial dispersion in the first instance, though natural agencies came into play in these districts



MAP SHOWING DISTRIBUTION OF PEAR-MIDGE IN NEW ZEALAND.

(1) Avondale (initial outbreak); (2) Waitemata and Eden Counties; (3) Huapai; (4) Komiti; (5) Te Kauwhata; (6) Hamilton; (7) Hastings; (8) Tasman; (9) Riwaka; (10) Redwood's Valley and Stoke.

after the initial establishment. It seems, therefore, that attention has not been given to the recommendation made in the former article (page 89, *Journal*, August, 1921) that "the greatest care should be taken in exporting from a midge area not only pear-trees but all nursery stock, since it requires but very little soil infested by midge-larvæ to spread this pest broadcast over a wide area."

INFLUENCE OF CLIMATE.

Though no detailed observations have been made on the extent to which the pear-midge is influenced by climate, there are certain features worthy of mention. It is well known that climate is a limiting factor in the establishment and dispersal of insects, and variations in the intensity of midge infestation and in the period of first spring emergence in the different districts seem, in part at least, to be due to differences in moisture.

The areas where infestation is most severe are in the Waitemata and Eden Counties, and at Tasman and Riwaka in the Nelson District, but particularly the former; while in Hawke's Bay infestation is comparatively light. Further, the emergence of the first spring brood of midges commences during late September in Waitemata and Eden Counties and also at Tasman and Riwaka, but during the second week of October in Hawke's Bay.

The following figures (kindly supplied by the Dominion Meteorological Office) show the total mean rainfall in the three main midge areas for the months April to October, when the hibernating midge-larvæ are in the ground: Auckland (area 2), 29·32 in.; Motueka (area 9), 32·32 in.; Hastings (vicinity of area 7), 22·62 in. These figures show that the rainfall at Auckland and Motueka is much higher than at Hastings. This feature, when correlated with the earlier spring emergence of midge in late September in the vicinity of Auckland City and in the two Nelson districts, and the later emergence in October in the Hawke's Bay area, shows that moisture has apparently a direct influence upon the emergence of the overwintering stage of the midge. There are at present no temperature statistics from actual midge-infested areas available for comparison, though figures from the meteorological stations at Auckland, Nelson, and Napier show that Auckland has the highest temperature and Nelson the lowest—a feature seemingly bearing out the opinion that moisture is the main climatic factor influencing midge emergence.

CONTROL WITH CALCIUM CYANIDE.

Owing to the pear-midge larvæ when on the trees being protected by the rolled-up leaves, none of the sprays tested have been sufficiently effective. However, the habit of the larvæ entering the ground to hibernate and pupate presents an opportunity for control.

Though a number of insecticides have been experimented with in soil-treatment (*Journal*, August, 1921), no results of a practical value were obtained until the present season, when calcium cyanide was used. This is a preparation manufactured by the American Cyanamid Company, New York, and at the time of these experiments was prepared in three forms—granules, flakes, and dust. Owing to later improvements in the manufacturing processes, however, the granules can now be made at less cost and placed on the market at the same rate as formerly charged for the flakes, which have been withdrawn. On the cyanide being exposed to the atmosphere, hydrocyanic-acid gas is generated, and its value as a soil-fumigant is at once apparent. The opinion has been put forward that too great a danger to life is involved by the use of this material, but that is by no means so if ordinary common-sense is used in its handling. Certainly the danger is comparatively small when the cyanide is used out of doors.

In the following experiments against one of the summer broods of midge, carried out at Mr. F. G. Platts's orchard at Henderson, the granular cyanide was used. Six dosages were laid out, each involving three plots of infested soil under as many trees, making a total of eighteen trees treated. Over the treated area under each tree two emergence tents were pitched, so that six observations were made for each dosage. As a check twelve tents were pitched under untreated trees. Owing to lack of sufficient cyanide the experiments were not made more extensive.

The dosages of cyanide to each area of 200 sq. ft. were as follows, the material being spread on the ground and worked, not turned, in with a spade: (1) 2 lb., (2) 1¾ lb., (3) 1½ lb., (4) 1 lb., (5) ¾ lb., (6) ½ lb.

An examination of the emergence tents at the time when the midges were due to emerge showed that the efficiency of the cyanide divided the dosages into two groups, one comprising dosages (1), (2), and (3), and the other the dosages (4), (5), and (6). In the first group there was 100 per cent. control, and in all of the second group but little control, if any. Certainly the weakest dosages, (5) and (6), cannot be claimed to have had any effect, since the numbers of midges emerging into the tents over these plots could not be said to be any less than those in the check tents.

Owing to results between the two groups of dosages—(1), (2), (3) and (4), (5), (6)—being so decidedly positive and negative, a later attempt was made with dosages of strengths each descending by 1 oz. from 1½ lb. to 1 lb. to every 200 sq. ft. of infested ground. In this experiment, carried out to determine if there was a weaker effective dosage between (3) and (4), thirty-six observations were made, exclusive of checks. Nine dosages, each involving infested ground under two trees, were applied. On each of these eighteen plots an emergence tent was pitched, together with an emergence box. This latter, turned mouth downwards, measured 10 in. (high) by 14 in. by 20 in. (inside measurements), and was lined with black paper. On the top five holes were bored, in each of which was inserted a glass tube 1 in. in diameter and open at both ends except for a muslin cap over the outer one. A cork fitted with a narrow tube was inserted into the opposite end within the box, in order to prevent any midges from leaving the tubes once they had entered. It was hoped by this means to make counts of the midges emerging from each dosage, but the moisture which collected in the bottom of each tube interfered with this.

The results of these experiments, however, as gauged from the tents, showed that the dosage of 1½ lb. to 200 sq. ft. was the weakest effective strength that could be used for 100 per cent. control. Acting on this basis it is intended to extend the work on a larger scale, treating whole orchards under commercial conditions in order to test the efficiency of the cyanide against the hibernating midge-larvæ. A point of interest in the experiments was that though the pear-midge was controlled by the stronger dosages, the latter had apparently no effect on certain other underground insects, since there was a general emergence in all the tents of such insects as the cicada (*Melampsalta cingulata*), and several ichneumon flies and muscid flies.

The quantity of cyanide required to treat a midge-infested orchard will vary with the spread of the trees. In mature orchards where trees

overlap, the full acreage must be treated at a maximum cost, but with upright mature varieties or younger trees less cyanide will be required, until a minimum is reached in a newly planted orchard or in a nursery. It is not known at present just what the exact cost of treatment with calcium cyanide would be, but in any case the results here recorded, together with the reduced price of the granules, show that at least young orchards (or even some mature ones) and nurseries, where isolated, could be economically treated at present.

That ordinary winter cultivation, if carefully carried out, will reduce the numbers of midges emerging in the spring has been proved (*Journal*, August, 1921), but no concerted attempt has been made to follow this line of treatment, which requires that orchards be well kept throughout the year, so that the thorough turning-in of the midge-infested surface soil is made possible during the insect's hibernating-period. Not only is the pear-midge so reduced in numbers, but also other insects hibernating underground.

THE PEAR-MIDGE PEST.

SPRAYING EXPERIMENTS AT HENDERSON.

R. H. MAKGILL, Auckland.

THE damage caused by the pear-midge in those parts of New Zealand which this pest has reached is so great, and the control is so difficult, that the writer ventures to record even the small measure of success he has obtained by repeated spraying in his orchard at Henderson, near Auckland.

In the annual report for 1919 of the Bristol University Horticultural Research Station Mr. A. H. Lees, Research Entomologist, describes a nicotine-paraffin insecticide spray having the following composition: Soft soap, 15 lb.; paraffin, 2 gallons; nicotine, ½ lb.; water, 100 gallons. He advocates the use of this spray in summer-time against woolly aphis.

In conversation with the writer Mr. Lees suggested that it might be found of service against pear-midge, not with a hope of destroying the well-protected larvæ, but in order to deter the adult female from laying her eggs. Trials were accordingly made in 1922 and again in 1924, but on both occasions in place of paraffin and soft soap given in the formula a miscible oil (" Olene ") was used in a strength of two parts per cent. As the paraffin is used chiefly as a carrier and spreader of the nicotine, it was thought that this change was of little consequence, and it simplified the making of the spray. Certainly the modified mixture acted well when used against woolly aphis, and its application for that purpose would have been continued had not the introduction of *Aphelinus mali* made its use unnecessary. If the mixture were carefully made no scorching of leaves resulted. However, it was found that if the nicotine (Black Leaf 40 being used) were put into the oil emulsion without previous dilution a certain amount of the oil was thrown out of suspension and floated as a scum. If this scum was sprayed on the leaves, especially of P. Barry, a certain amount of scorching resulted.

The trees selected for experiment were eighteen young pears of mixed varieties, planted in 1922 in a block of land newly broken in from pasture that year. Fifteen P. Barrys planted in 1921 among other older pears were also used.

SEASON 1922–23.

In 1922 the midge was detected in the tent traps on 14th September, but no female midges were found till 1st October. The Black Leaf and oil spray was first applied on 3rd October to the newly planted block of pears and to nine of the P. Barry trees.

On 10th October the first evidences of infestation were detected on some Beurre Diel trees next to the P. Barrys, and five days later it was seen on the P. Barrys which had not been sprayed. None of the sprayed trees showed any signs of the midge.

On 25th October the ground immediately around all the young pear-trees was sprayed with pure kerosene, with a view to attacking the pupæ which by that time would be due to hatch out from the first infestation.

On 1st November the P. Barry trees were sprayed with a mixture composed of molasses, 6 lb., to 100 gallons of water, and Black Leaf 40, one part in 1,000. This spray seemed to act well, for, despite daily rain showers, by 8th November the newly formed shoots showed no signs of midge-infestation, and the odour of the Black Leaf could still be detected on the sprayed leaves. This was not due to the kerosene spraying of the ground, as other trees so treated but which had not received the Black Leaf and molasses mixture showed infestation. It was decided then to continue to treat the P. Barry trees with this spray, and use the Black Leaf-oil spray only on the newly planted pears.

The next application of the Black Leaf and molasses mixture to the P. Barrys was on 21st November, three weeks after the first. It was found, however, that this interval was too long, because, although the Barrys were nearly free from infested leaves at the time the second spray was applied, by 27th November a fairly wide infestation was manifest, and as the leaves were by then beginning to blacken it seemed probable that the eggs were layed just prior to the second spray. The constant rains during the first fortnight of November no doubt contributed to the failure of the remedy. The spray was repeated on 6th December, but with little effect, and for the rest of the year the Barrys were markedly infested with midge.

Turning again to the block of newly planted pears which had been sprayed on 3rd October with the Black Leaf and oil mixture, in common with other pears the ground round these trees was treated with kerosene on 25th October, but the trees were not again sprayed with the mixture till 10th November. At this time scarcely one infested leaf could be found on the eighteen trees, which had made satisfactory growth and had acquired a good crop of leaves.

On 21st November a female midge was observed laying eggs on one of these trees, showing that the spray had lost its effect during the eleven days which had elapsed since its application. The spray

was accordingly repeated on the same day, but by 27th November a fairly widespread infestation of the new leaves was apparent, the eggs probably having been deposited prior to 21st November.

The spray was repeated on 5th and 22nd December, 14th January, and 3rd February, but with very little result during December and January, and during these months there was little new growth or formation of serviceable leaves. After the final spraying on 3rd February, however, some midge-free leaves developed during the ensuing week, but no further observations were made that season.

During the same season a number of adult Bon Chretien and Beurre Bosc pear-trees were sprayed with the Black Leaf and molasses mixture, the dates being 1st and 21st November and 6th December. The spraying on the first of these dates was productive of some result, as the new growth was fairly free from midge infestation till 10th November. Thereafter the midge appeared to gain ground, and the two last sprays had little, if any, effect.

SEASON 1923–24.

During the season 1923–24 only the Black Leaf and molasses mixture was used—applied about every third week. As before, the young trees were kept almost free from midge infestation till the last week in November, after which the spray showed little effect, and was not repeated after December.

SEASON 1924–25.

It was thought that possibly a better result might be obtained with more frequent sprayings, so during the spring of 1924 the new block of pear-trees was treated with the Black Leaf and oil mixture once a week. The dates of the sprayings were 6th, 13th, 21st, and 27th October, 1st, 10th, 17th, and 24th November, 1st, 7th, 15th, 22nd, and 29th December, and 5th January.

This season the midge infestation was noticed first on the Beurre Diel leaves about 13th October, the leaves beginning to blacken about the 18th. By 27th October the young pears sprayed with the mixture were quite free from midge, except a small tree, planted this season, which stood apart and was overlooked in the spraying on 13th October. During the first three weeks of November this freedom continued, only one or two leaves—which perhaps had not been well sprayed—showing infestation. The trees by now had made a reasonable growth and had a good crop of leaves. Some continued wet weather about the middle of November may have weakened the spray deposits on the twigs, for on 26th November slight infestation was found on all the trees.

It may be doubted, however, whether rain alone was the cause of the spray losing its effect, for on 4th December, only three days after the last spraying, a female midge was found depositing eggs on a bud. The weather had not been wet, and the question arises whether the increasing temperature may not have been responsible for the failure, nicotine being a volatile substance. However this may be, from December onwards the spraying failed to control the midge, thus repeating the experience of the two previous years.

During this season a material sold as Vistolene was tried in a strength of 1 part in 100 parts of water on the P. Barry trees. The dates of the sprayings were 21st October, 10th November, and 1st and 7th December, while one tree was sprayed with the Black Leaf and oil mixture each week on the same dates as were the block of younger trees. The first two sprayings with Vistolene had some effect, the treated trees showing considerably less infestation than neighbouring unsprayed trees, though not nearly so free as the tree which received the weekly treatment. The Vistolene had little effect after the middle of November, however.

CONCLUSIONS.

The results suggest that by the use of nicotine the pear-midge can be kept in check during October and the first two weeks of November sufficiently to permit of the early twig-growth becoming established and to enable the trees to set a fair covering of leaves. This is certainly an advantage, especially when dealing with young growing trees. Some of the treated trees, planted in 1922, are now over 6 ft. in height, contrasting favourably with untreated trees of like varieties, which have made little growth in the same time. Insufficient experiments were made to demonstrate whether with adult trees the destruction of buds by the midge could be delayed sufficiently to enable the fruit to set, and to allow of the establishment of the leaves necessary to the nutrition of the fruit-bud.

The Keiffer variety appears to be attacked by the midge just as much as other varieties, but, being of early habit, the buds have set and the leaf crop is established before the midge has become prevalent. After the middle of October the new growth on the Keiffer is infested Growth is checked, but not the fruit crop. With later-blossoming varieties, such as Bon Chretien and Beurre Bosc, the difficulty arises that measures taken to combat the midge must also tend to discourage the visits of bees, and thus pollination may be interfered with. Spraying should be suspended while the blossom is fully open.

From the middle of November till late in February nicotine loses its effect. During the seasons under consideration wet weather may have been responsible for this failure—at least in November; but the effect of the increasing temperature on a volatile substance like nicotine has to be considered. Again, it has been shown by Miller that, after the hatching-out of the second infestation between 1st and 10th November, the midge remained on the wing for the remainder of the month. This must greatly increase the difficulty of protection. This raises the question of the frequency of spraying. During October the results when the spray was applied weekly were little better than when applied at intervals of three weeks, but in the latter part of November it appeared that a weekly spraying was insufficient. It is proposed next spring to apply fortnightly sprays during October, weekly in the first half of November, and thereafter bi-weekly sprays, by way of experiment. From the commercial point of view bi-weekly spraying can hardly be regarded as practical.

In regard to the composition of the spray, the nicotine salt is the active agent, and the most suitable "carrier" has not been determined. On the whole the miscible oil appeared to give the most lasting results. If ordinary oil be used it is advisable to use a strength

not greater than $1\frac{1}{2}$ per cent., owing to the tendency to scorch. Molasses proved satisfactory, and is easily dissolved. Possibly a simple soap solution may be found equal to the agents tested.

The experiments with Vistolene were not sufficiently extensive to warrant a definite opinion, but it did not seem as effective as nicotine.

The results of the various trials viewed in general were disappointing, but suggest that in the use of a deterrent spray the solution of the problem may be found.

WHITE BUTTER FROM HEIFER'S MILK.

E. E. ELPHICK, M.R.C.V.S., D.V.H., Veterinarian, Wellington.

AN interesting local case of abnormality in a cow's milk has recently come under the writer's notice. The animal concerned, a $3\frac{1}{2}$-year-old Friesian-Ayrshire cross, calved for the first time on 30th January last. A feature of her first milk, which at once drew the owner's attention to it, was the entire absence of visible colostrum. Later there appeared to be no cream on the milk, which had a uniform fixed white colour throughout. The owner, who happens to sell a little milk, thinking perhaps there was a considerable deficiency in butterfat, had the milk tested, when it gave a 4·35-per-cent. test. The heifer was running on good pasture, and was not getting hay or other dry feed. A proportion of her milk has since been set for cream and churned, with the result that the product has been a perfectly white butter.

According to Palmer (Missouri Circular 74, 1915) the natural yellow colour of butter is derived from two yellow pigments—carotin and xanthophyll—which are also present in the green chlorophyll of plants. These pigments, particularly carotin, are found in the cow's blood, and in this way pass from the feed to the udder, where they colour the milk-fat. Certain feeds are classified according to their carotin content, this explaining why cows fed on green pasture produce a yellower butter than when they receive dry fodder and grain by-products in winter. It is further stated that the high-coloured fat of the Channel Island breeds is due largely to the fact that they make use of more feed carotin than others. It is also common knowledge that the colour of butter varies with the period of lactation. There is no difference, however, immediately after parturition in any breeds, the colostrum of all cows being highly coloured. As the period of lactation advances the intensity of the colour decreases.

The peculiarities of the present case may be summarized as—(1) A newly calved heifer giving a milk apparently free of colostrum, or if colostrum was present it was entirely lacking in pigment; (2) the feed is green pasture, which is rich in high-colour carotin; (3) the heifer is at the commencement of her lactation period and not at the end, when a low-coloured butterfat would be expected, particularly in a cow of her breed.

The explanation appears to be a physiological one. Either the yellow pigment from the feed has not been assimilated during the process of digestion, or there is some deficiency or peculiarity in the cellular elements of the milk-glands which has rendered them incapable of extracting these pigments from the blood-stream.

WHEAT MANURIAL TESTS IN CANTERBURY.

SEASONS 1923–24 AND 1924–25.

F. E. WARD, Instructor in Agriculture, and A. W. HUDSON, Assistant Instructor in Agriculture, Christchurch.

DURING the season 1923–24 the Canterbury Soils Improvement Committee conducted three manurial trials on wheat, and this season—1924–25 — the Fields Division of the Agriculture Department has completed an additional seven. The results, which indicate a decided increase in yield from phosphate manuring, are given in a concise form in the following pages, but readers interested in a full account of the experiments, the results of which were treated statistically, may be referred to a bulletin which it is proposed to publish later.

MANURES USED.

The manures used were as follows, the quantity being per acre in each case :—

Season 1923–24: (1) Superphosphate (42/44), 1 cwt. ; (2) superphosphate (42/44), ¾ cwt., plus dried blood, ¼ cwt. ; (3) basic superphosphate, 1 cwt. ; (4) basic superphosphate, ¾ cwt., plus dried blood, ¼ cwt.

In 1924–25 it was decided that in order to get a true estimate of the value of dried blood this constituent should be added to the same quantity of phosphatic fertilizer as was sown on the plots having phosphate alone. Therefore the mixtures of phosphate and blood were sown at the rate of 1 cwt. phosphate plus ¼ cwt. of blood per acre. Manures (1) and (3) were repeated unaltered.

The object in the selection of the manures used was to test the soluble phosphate—super—against the less soluble phosphate—basic super—and to ascertain the effect of nitrogen as dried blood in combination with these fertilizers. All fields contained controls, or non-manured areas, so that the increases due to manuring could be estimated.

METHOD OF SOWING.

The fertilizers were applied in long narrow strips, and repeated several times in the same field. Numerous weighings were made in each strip, enabling great reliance to be placed on the results obtained. The fertilizers were applied with great care under the personal supervision of the writers. Known areas were first drilled with a given weight of manure, and adjustments made until the drill was sowing exactly the amount required. This was done with each manure in turn, as different manures run at different rates, and the same manure will run differently under varied climatic conditions. When these drill adjustments had been made, the drilling of the plots was proceeded with.

During the growing-period observations were made from time to time. In all cases, except the Irwell plots, marked differences could

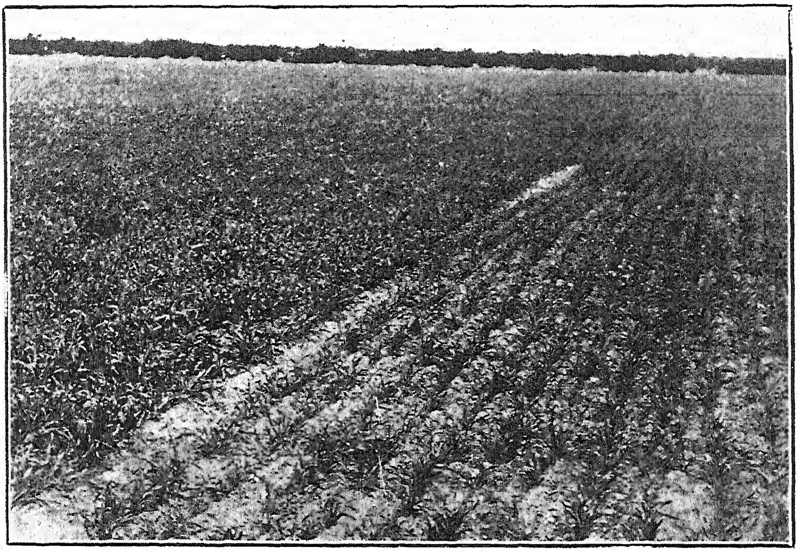


FIG. 1. ADJACENT PLOTS, SHOWING TYPICAL DIFFERENCES IN THE EARLY SPRING BETWEEN TREATED AND UNTREATED AREAS.

Left—manured area ; right—no manure.

FIG. 2. SHOWING MANURED (LEFT) AND UNMANURED (RIGHT) PLOTS.

The difference between plots was here very apparent at harvest-time. In some cases differences which were very marked in the early spring were scarcely discernible at harvest-time.

be seen between the manured and non-manured areas, but no definite superiority of any one manure over another could be discerned.

METHOD OF HARVESTING.

Season 1923–24: Areas of approximately $\frac{1}{4}$ acre were carefully measured, and the number of sheaves dropped by the reaper-and-binder on that area was noted. A large number (twenty-two) of these sheaves from each area was weighed to the nearest ounce, and thus the average weight of sheaves on each treatment was obtained. The product from these strips, which were at least 5 chains long, was stooked separately, and when fit to thresh the bands of several sheaves taken indiscriminately were cut and handful samples taken. These were tied and the heads placed in small bags to avoid loss. Each sample was carefully weighed, and flail-threshed in small strong bags. The grain from each sample was then weighed, and the ratio of grain to straw calculated. From the data so obtained the yields per acre were calculated. This method, planned by Mr. M. J. Scott, chemist at Lincoln College, though involving a large amount of very careful work, gave highly satisfactory results, the calculated yields being practically identical with threshing returns at the College.

Season 1924–25: This year the actual sheaves from the plots were threshed in a small mill adapted to the purpose. Smaller areas were cut either with scythe, reap-hook, or reaper-and-binder, and the product stooked and threshed separately. By this method the plots were in closer proximity to the controls, and the difficulties of land variation were largely overcome. Varying-sized plots, from $\frac{1}{180}$ acre to $\frac{1}{50}$ acre, were cut in different fields. Where small plots yielding about five sheaves were cut a large number was taken. With the larger plots yielding about sixteen to eighteen sheaves few plots were required. The method was highly satisfactory, and overcame some of the experimental difficulties which occurred in the previous season.

RESULTS OF THE EXPERIMENTS.

The results so far show a definite increase from both forms of phosphate, but no conclusions can yet be drawn as to which is the better form. Likewise, sufficient data are not yet to hand to enable an estimate of the value of dried blood to be made The yields are given in the following records. In the 1924–25 experiments the yields on manured plots are compared with those of the controls situated immediately alongside them, each manure being adjacent to a control.

Season 1923–24.

Experiment 1: On farm of Mr. R. T. McMillan, Irwell. Previous crops—1922–23, barley; 1921–22, wheat; 1920–21, grass. Date of sowing experimental plots—First week in June, 1923. Variety of wheat—College Hunters. Yields per acre—Super, 41·8 bushels; basic super, 42·3 bushels; super and blood, 42·9 bushels; basic super and blood, 43·1 bushels; controls, 41·4 bushels. The application of the statistical method proved the differences to be non-significant, and the slight differences which occurred are due merely to chance variation.

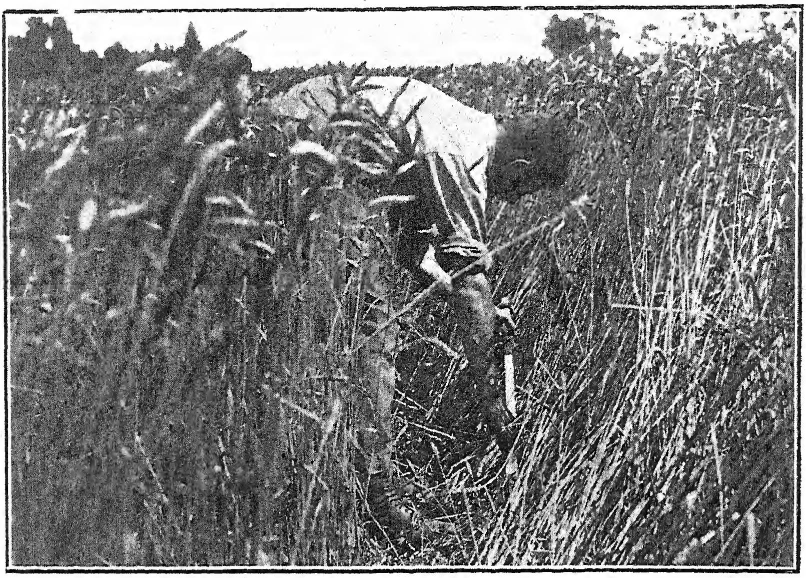


FIG. 3. PREPARING FOR HARVESTING OF PLOTS BY BINDER.

Where no difference in ripeness between plots occurred the binder was used, and plots of a definite length and a definite number of "coulters" in width were marked out by pressing the standing crop (along a coulter mark) in direction of wind.

FIG. 4. HARVESTING PLOTS WITH REAP-HOOK.

Owing to differences in ripening between plots in some cases (the phosphated plots ripening first) it was necessary to cut at different times. The reap-hook proved to be a convenient (though slow) means of cutting. The photo shows two adjacent plots being reaped, the wheat being laid in neat sheaves and tied by hand.

Experiment 2: On farm of Messrs. W. and A. Campion, Prebbleton. Previous crops—1922–23, wheat; 1921–22, potatoes; 1920–21, grass. Date of sowing of experimental plots—Early in June, 1923. Variety of wheat—College Hunters.

Fertilizer.	Yield per Acre.	Increase per Acre due to Manure.	Cost of Manure per Acre.*
	Bushels.	Bushels.	s. d.
Super	46·3	9·0	7 3
Basic super	42·4	5·1	6 9
Super and blood	43·6	6·3	8 8
Basic super and blood	41·6	4·3	8 4
Control	37·3	..	..

* Based on following prices at county stations: Super (42/44), £7 5s. per ton; basic super (40/43), £6 15s. per ton; blood, 13s. per cwt.

NOTE.—The value per bushel of the additional increase will be the market value of the wheat less harvesting, threshing, and haulage costs per bushel. Apart from the cartage and trouble of sowing manure, a high-yielding crop costs no more to sow than a low-yielding one.

Season 1924–25.

The table of results of the 1924–25 experiments (next page) shows no differences between yields in the Irwell tests, except in the case of basic super and blood. This is because the differences which do occur are, like those of the previous year, non-significant. The yield of basic super and blood shows a significant decrease below that of its control. This provides a very interesting case, which we do not pretend to be able to explain, but it is a noteworthy fact that a similar result was obtained with this manure in an experiment conducted by Mr. M. J. Scott at Lincoln College in 1923–24.

FIG. 5. SMALL THRESHING-MILL PLANT ADAPTED TO CEREALS.

Threshing operations in progress at one of the experimental areas. Note tripod breakwind to facilitate weighing with sensitive balance. Portable 5–7 h.p. petrol-engine.

1924-25 Experiments.

Farmer and Locality.	Previous Crops.	Date of Sowing of Experimental Plots.	Yields, in Bushels per Acre.		Increase due to Manure.	Yields, in Bushels per Acre.		Increase due to Manure.	Yields, in Bushels per Acre.		Increase due to Manure.	Yields, in Bushels per Acre.		Increase due to Manure.	Variety of Wheat.
			Super.	Control.		Basic Super.	Control.		Super and Blood.	Control.		Basic, Super, and Blood.	Control.		
R. T. McMillan, Irwell	1923–24, peas .. 1922–23, wheat 1921–22, fallow	17/5/24	41·0	39·8	..	42·0	41·8	..	42·5	42·4	..	40·1	42·5	−2·4	College Hunters.
J. Foster, Ladbrooks	1923–24, grass.. 1922–23, grass.. 1921–22, grass..	11/6/24	51·0	44·7	6·3	52·9	44·7	8·2	57·1	47·7	9·4	53·4	47·7	5·7	College Hunters.
W. & A. Campion, Prebbleton	1923–24, vetches 1922–23, vetches 1921–22, turnips	20/5/24	53·4	49·4	4·0	54·4	49·4	5·0	56·4	52·4	4·0	54·9	52·4	2·5	College Hunters.
F. Carpenter, Prebbleton	1923–24, vetches 1922–23, vetches 1921–22, oats ..	9/6/24	49·3	41·2	8·1	48·2	41·2	7·0	47·3	38·8	8·5	45·4	38·8	6·6	College Hunters.
F. Morrish, Springston	1923–24, rape .. 1922–23, wheat 1921–22, grass..	19/5/24	38·4	35·1	3·3	39·3	35·4	3·9	39·0	31·5	7·5*	38·0	33·0	5·0	College Velvet.
W. & A. Campion, Prebbleton	1923–24, potatoes 1922–23, grass.. 1921–22, grass..	28/6/24	38·3	28·9	9·4	36·8	28·9	7·9	36·7	23·5	13·2†	36·3	23·5	12·8†	College Hunters.
F. Carpenter, Prebbleton	1923–24, potatoes 1922–23, grass.. 1921–22, grass..	10/6/24	43·7	32·9	10·8	39·6	32·9	6·7	42·0	31·8	10·2	43·5	31·8	11·7	College Hunters.
Average increase due to manures (excluding McMillan's experiment)			..	..	7·0	..	..	6·4	..	..	8·8	..	..	7·4	

Cost of manures per acre: Super, 7s. 3d.; basic super, 6s. 9d.; super and blood, 10s. 6d.; basic super and blood, 10s. 2d.

In all other cases the increases are highly significant, but the behaviour of the various manures on different farms emphasizes the necessity of carrying out experiments in different places and for a number of seasons before definite conclusions can be drawn.

Footnotes to Table of 1924–25 Experiments (opposite page).

* The large increase for super and blood over control in this case must be regarded with caution. The plots cut for the estimation of yield had the misfortune to be disturbed by stock while in stook, and those that were mixed had to be discarded. It so happened that at one end of the manured strips the differences between manures and controls were much greater than at the other. The plots from which the super and blood yields were estimated were mainly from the end of greatest differences, the plots from the other manures being chiefly from the portion of least difference. It is likely, therefore, that in this case the super and blood has an unfair advantage.

† Here again the comparative large increases from the mixtures containing blood are due to the low-yielding controls with which they are compared. Whether the same increases would have been caused by the phosphate alone one cannot say, but if basic super is compared with basic super and blood in this experiment it will be noted that there is practically no difference between them. This comparison is justified, as these two treatments were adjacent to one another in the experiment.

The writers wish to express their appreciation of the generous assistance given by the farmers on whose farms the trials were conducted; also their indebtedness to Dr. F. W. Hilgendorf and Mr. M. J. Scott for much valuable advice given in planning the experiments and application of the statistical method. To Messrs. A. Scott, J. B. Garnett, E. R. Hudson, E. Bates, and M. Grant, who at various times assisted in the harvesting operations, our thanks are due.

The Te Mania Rabbit-proof Fencing District has been abolished by Order in Council gazetted on 19th March.

Impounding Act.—Sections 5 and 6 of the Impounding Act, 1908, have been brought into force in Maniototo County.

Seed Impurity in New Zealand Barley.—The High Commissioner recently forwarded a packet of small round seeds which had been collected by a Birmingham merchant from New Zealand barley passing through his hands during the last few years. The impurity has been dentified as four-seeded vetch (*Vicia tetrasperma*). The matter has been reported by the Department of Agriculture to the New Zealand Grain, Seed, and Produce Merchants' Federation. There should be no difficulty in dressing this weed-seed out of any lines of barley exported.

Wheat and Oats Threshings.—Returns of actual threshings up to 19th March received by the Government Statistician from threshing-mill owners showed that until then 1,144,359 bushels of wheat and 1,380,135 bushels of oats had been threshed out. The average yields per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 34·73 bushels for wheat and 40·90 bushels for oats. The figures for the Canterbury and Otago Land Districts respectively were as follows: Canterbury—Wheat, 977,724 bushels threshed, averaging 35·27 bushels per acre; oats, 937,017 bushels threshed, averaging 41·41 bushels per acre. Otago—Wheat, 136,697 bushels, averaging 32·43 bushels per acre; oats, 245,254 bushels, averaging 39·86 bushels per acre.

PRESERVATIVE TREATMENT FOR FARM TIMBER.

I. METHODS OF DEALING WITH FENCING-POSTS.

A. R. ENTRICAN, Engineer, State Forest Service, Wellington.

FENCING-COSTS have risen to such heights during the last few years that they now form one of the major expenses of farm maintenance and improvement. Post and other timber prices have led the general upward tendency in the prices of construction materials, and reflect the serious depletion of our forest resources. Hitherto farmers have procured their fencing-posts from timber growing on the farm or in the immediate vicinity, but they are now becoming increasingly alive to the scarcity of naturally durable woods.

Many non-resistant species are available at comparatively low prices from the native forests and the farm plantations. Labour costs, however, form such a large proportion of the total fencing-charges that the use of these posts is a poor investment except for fences of a purely temporary character. This disadvantage may be overcome by so treating the posts with an approved wood-preservative that they are able to compare favourably and economically with posts of the more durable timbers. The treatment is a relatively simple one, and its principles easily understood. For those methods available to the farmer the equipment required is cheap and easily procurable. The use of ordinary care in its operation will render a high degree of efficiency in the treatment.

A similar position exists with reference to other farm timbers, such as service telephone and electric-power poles, foundation timbers, barn timbers, bridge timbers, wooden gates, windmill-frames, well-kerbing, &c. For the up-to-date and progressive farmer the preservative treatment of such material will conserve his wood-supplies and render a substantial saving in expenditure.

NATURAL DURABILITY OF TIMBER.

The destruction of wood by decay is due to low forms of plant-life known as fungi which use as food certain substances of the wood. These fungi consist for the most part of fine thread-like filaments which penetrate the wood-cells, disintegrating the wood substance and leaving behind the punky powdery residue so characteristic of decayed wood. In places the filaments grow out to the surface of the wood to form compact bodies, such as the bush fungus of commerce, frequently found growing on the trunks of both living and dead rimu, beech, tawa, mahoe, and other trees. They are an indication of advanced decay, and function as spore-producers, spores corresponding to the seeds of the higher orders of plant-life. Like these latter, they are distributed principally by the wind. Certain conditions of air, moisture, temperature, and food are necessary for their germination and the subsequent growth of the fungi. According to the control exercised over these factors, either by the nature of the wood itself or by the conditions under which it is used, will the natural durability be affected.

As the sap-wood of all trees contains a large amount of protoplasm, starch, and other essential plant-foods, it exhibits poor durability, seldom exceeding four years when in contact with the ground. The natural durability of heart-wood varies with the timber. It is considered to be determined largely by the presence of certain vital oils which prevent the growth of fungi.

DURABILITY OF NEW ZEALAND TIMBERS.

New Zealand has been fortunate in its supplies of durable fencing-timbers. Totara ranks first in importance, but is becoming increasingly scarce. Table 1 has been prepared to show the average range of life of the principal commercial timbers, including both native and introduced woods. The figures given refer to posts cut from the heart-wood of sound and healthy mature trees grown and used under average conditions of soil and climate. The woods in Class 6 are generally used for temporary fences only.

Table 1.—Average Range of Life of the Principal Fencing-timbers used in New Zealand.

Class 1: Over 30 years—Puriri, silver-pine, totara, broadleaf.

Class 2: 20 to 30 years—Kowhai, hinau, kawaka, black-locust.

Class 3: 15 to 20 years—Hard red and black beech, matai, jarrah.

Class 4: 10 to 15 years—Maire, kauri, *Eucalyptus amygdalina*, *E. botryoides*, *E. coriacea*, *E. eugenioides*, *E. Macarthuri*, *E. viminalis*, *E. obliqua*, *E. globulus*.

Class 5: 5 to 10 years—Pukatea, rata, manuka, mangeao, mountain-beech, tanekaha, tawhero, kamahi.

Class 6: Under 5 years—Rimu, silver-beech, white-pine, rewarewa, taraire, tawa, miro. All thinnings and immature timber of the eucalypts in Class 4, and of pines, spruces, larches, and softwoods usually planted.

Users of posts are warned against drawing rash conclusions from these summarized data. The conditions of growth, the quality of the timber, and the conditions of use to which the figures apply must all be considered in studying the table.

CONDITIONS OF GROWTH.

Posts cut from immature and fast-growing trees generally exhibit little resistance to decay. The average range of life of even the durable species, such as ironbark, is only eight to twelve years. That of the remaining woods is reduced proportionately.

Late autumn and winter are the best seasons for felling trees. The timber then dries slowly and evenly, minimizing splits and checks, in which insects and fungi usually commence their destructive work. Insects are noticeably absent at this time of the year, and by late spring the wood will have dried sufficiently to resist the attack of these pests. Almost equal durability is obtainable from wood cut at other seasons of the year, but rigid precautions must be observed if excessive splitting and checking, and insect and fungal attack, are to be avoided.

INFLUENCE OF CLIMATE AND SOIL.

Climatic conditions in New Zealand are conducive to decay throughout the year. The climate is typically a temperate one. Except in a few localities there is a copious and well-distributed rainfall and a high atmospheric humidity, both of which produce conditions favourable to decay. Shrimpton (1) reports that the

average life of Australian hardwood poles is greater in the dry localities on the east coast of the South Island than in wetter and more humid districts. Crawford (2) confirms this statement, finding that the same species give a higher average life in the dry, far west of New South Wales than in the wetter coastal regions.

Decay is most active near the ground-line, where the wood is continually damp through contact with the wet ground. In damp clayey soils the decay extends only 2 ft. to 3 ft. below the surface, but in loose and sandy soils, where the air-supply is better, it may reach to depths of 5 ft. to 6 ft. Post-tops, joints in framed timbers, and other points where water collects also exhibit serious decay. In the presence of excessive moisture, however, decay cannot proceed, as illustrated by the kauri and silver-pine logs which are being recovered from swamps in which they have been buried for hundreds of years.

RELATIVE DURABILITY OF GREEN AND SEASONED TIMBER.

Hicks (3) and other authorities (4) report that the natural durability of untreated wood is slightly greater for timbers set green than for those placed after seasoning, a view which is supported by Shrimpton (1) as a result of his experience with poles in New Zealand. This may be explained by the fact that whatever the moisture content of the timber when first placed, that portion below the ground-line must ultimately come into equilibrium with the moisture content of the surrounding soil. By placing the post or timber when green, splits and checks will be largely eliminated at the ground-line, thus avoiding a condition favourable for decay.

PRINCIPLES OF WOOD-PRESERVATION.

In commercial timber-treating practice natural durability is improved by injecting antiseptics to poison the wood substance upon which the fungi live. Except in the case of a few porous woods it is impracticable to impregnate the wood throughout, it being the usual practice to create an outer protective envelope around the untreated interior wood. It is generally assumed that the increased durability due to any treatment will be in approximate ratio to the depth of penetration and to the amount and permanency of the preservative employed. Since it is difficult to treat the heart-wood of most timbers, the natural round post is the most satisfactory form of timber for treatment. Where the heart-wood is naturally durable, however, split and sawn posts containing a proportion of sap-wood may be treated with advantage. The financial saving due to a preservative treatment is obviously greater when applied to a non-durable wood than to a durable timber.

The important wood-preservatives fall into two general classes—coal- and wood-tar derivatives, such as creosote, carbolineum, &c.; and mineral salts, such as zinc chloride, sodium fluoride, &c. The latter, being water-soluble salts, are not suitable for fencing-post work in New Zealand unless employed in conjunction with creosote oil, crude petroleum, &c., which will resist the natural tendency of our rainfall to leach out the preservative and render the wood non-resistant to decay. The two factors governing the value of

a preservative are toxicity and permanency, but these are not often possessed by the same material. For this reason, and on account of the rising costs of creosotes, increasing attention is being paid to the use of such mixtures as creosote and crude petroleum, and zinc chloride and crude petroleum.

PREPARATION OF WOOD FOR TREATMENT.

Except for pressure processes all timber should be thoroughly seasoned before treatment. Care must be exercised to prevent insect and fungal attack during this period. The primary objects of seasoning are to facilitate the penetration of the preservative and to prevent the exposure of untreated wood by checking and splitting after the timber has been treated. All framing—that is, cutting, notching, boring, &c.—of timbers should be done before treatment, otherwise subsequent framing will expose untreated wood, which will require further protection.

METHODS OF APPLYING PRESERVATIVES.

Impregnation under pressure is the most satisfactory method of treating wood with preservatives. Pressure plants are seldom available for farm use, but, where possible, should be used, as they give a more efficient and economical treatment.

The open-tank process is the most effective method of treatment for farm use. Although referred to as a non-pressure process, it uses atmospheric pressure to secure impregnation of the wood. The posts are heated for a certain period in a hot bath of the preservative maintained at a temperature of 180° to 200° F. This has the effect of partially expanding and driving out the air and moisture in the wood. On transferring the posts to a cold bath of the preservative maintained at a temperature of 90° to 100° F., or on allowing the hot bath to cool, the air and moisture in the wood contract and the atmospheric pressure forces the preservative into the timber. Except in the case of a few easily treated woods, there is little absorption of the preservative during the hot bath. The periods of immersion in the hot and cold baths vary with the species.

A few porous woods such as *Pinus radiata (insignis)* and *P. muricata* may be successfully impregnated by soaking in a bath of the preservative at ordinary air-temperatures, but the timber must be particularly well seasoned.

In the dipping process the wood is immersed for a period of from five to fifteen minutes in a hot bath of creosote maintained at a temperature of 180° to 200° F. For this treatment the timber requires to be not only thoroughly seasoned but also free of any surface moisture due to rain, dew, &c. Some porous woods are impregnated to a depth of 1 in. by the dipping process, but generally the penetration is small, although most checks and splits are well covered with the preservative.

A brush application of hot creosote or carbolineum is the simplest treatment available for the farmer. The treatment should be in the nature of a swabbing or mopping of the preservative over the wood, rather than a mere painting application. This tends to fill checks and splits which are otherwise unprotected. The presence of superficial

moisture is fatal to the process. Two coats are usually applied, the first being allowed to dry before the application of the second.

ABSORPTION AND PENETRATION.

The amount of preservative absorbed by the sap-wood varies with the timber, the pines absorbing as much as 30 lb. per cubic foot of wood, and the eucalypts only 15 lb. per cubic foot. A minimum absorption of 20 lb. per cubic foot for pines and of 10 lb. per cubic foot for eucalypts is recommended for the butt treatment of posts. For the upper portion of the posts the minimum absorption should be at least half that recommended for the butt treatment.

For posts and other timbers in contact with the ground it is preferable that the whole of the sap-wood and as much of the heart-wood as possible be impregnated, but this is sometimes difficult to accomplish, and impossible on the score of economy. The minimum penetration recommended by the Forest Service is 1 in.

HOW TO PRESERVE FENCING-POSTS AND OTHER FARM TIMBERS.

Only sound wood free from decay is suitable for treatment. Once started, decay is not necessarily stopped by the preservative, but may continue to destroy the interior of the wood beneath the treated portion. It is necessary to bark or peel all round forms of timber immediately after felling, preferably in the winter, otherwise fungi and wood-boring insects quickly commence their destructive activities beneath the loose pieces of bark, where the moisture tends to collect, and where conditions are favourable for rapid decay. The removal of the thin inner bark of the wood is important, as comparatively small particles prevent penetration of the preservative, and their removal after treatment exposes a surface of untreated wood through which decay enters.

Fence-posts are best seasoned by open piling, as shown in Fig. 1, in a shady yet exposed locality where there is ample circulation of air both beneath and through the whole pile. Damp ground and both living and rotting vegetation are to be avoided. Too rapid seasoning damages timber by excessive splitting, &c. This applies particularly to locally grown Australian hardwoods.

Poles and large structural timbers which show a tendency to split are best protected by the use of S-shaped irons, which are driven into the wood across the incipient splits to hold the timber in place. They are to be purchased for a few pence each. End coatings, such as coal-tar, pitch, and petroleum residue, effectively prevent end-checking.

Under favourable conditions posts season sufficiently for treatment in from 60 to 180 days, according to the species and to the period of the year. Only the sap-wood or that portion to be treated requires to be thoroughly seasoned. By weighing a few specimen posts at regular intervals the state of seasoning is obtainable with fair accuracy. When the weights remain fairly constant during two weeks of good seasoning-weather the posts are dry enough to treat. A glazed appearance on the surface of the posts is a sign of case-hardening, which seriously retards penetration. It is remedied by shaving off the hardened surface for a distance of 6 in. above and below the ground-line.

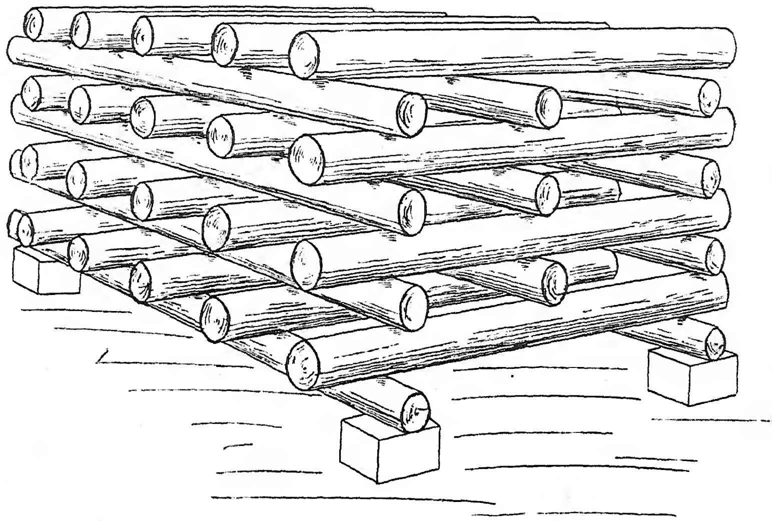


FIG. 1. SHOWING METHOD OF OPEN PILING OF POSTS FOR SEASONING.

PRESERVATIVES. (SEE APPENDICES FOR SPECIFICATIONS.)

For general farm-work a good grade of creosote containing a low percentage of low-boiling oils is recommended. Either the British Standard Specification or any of the three grades specified by the American Wood-preservers' Association can be used with confidence.

Carbolineums are generally proprietary preservatives containing higher-boiling oils than the creosotes. They are invariably higher in price, but only for brush or spray treatments are they superior to creosote. The American Wood-preservers' Association's specification is recommended to consumers of this class of preservative.

A number of low-temperature creosotes are now available on the New Zealand markets, and in the absence of a standard specification the Forest Service will shortly issue a tentative specification. These preservatives are superior to both ordinary creosote and carbolineum, both from the point of view of toxicity and of permanence.

Coal-tar is not recommended as a wood-preservative, as more harm than good is likely to be done if the timber is not thoroughly dry. Nevertheless Bradley (5) has successfully treated *Pinus radiata* posts by soaking them in a hot solution of this material.

CONSTRUCTION OF TREATING PLANTS.

The same plant may be used for the open-tank, soaking, dipping, or painting process. The simplest equipment consists of a 90-gallon steel oil-drum measuring approximately 3 ft. 4 in. in height and 2 ft. 4 in. in diameter. These drums may be purchased from benzine companies at an approximate cost of 30s. One end is knocked out, and the drum filled with about 40 gallons of creosote or other preservative. It is placed over a fire-trench in the ground, a fire

lighted, and the preservative heated up to a temperature of 200° F. The posts are placed with the butt ends in the tank and given the requisite hot bath, at the conclusion of which the fire is withdrawn and the posts allowed to cool off until the desired penetration and absorption have been obtained. The posts are next upended and the tops given a somewhat lighter treatment. If two of these drums are provided, one for the hot bath and one for the cold bath, the process can be carried on continually, without the necessity of waiting for the cooling of the hot bath.

Much economy of time, effort, and material is secured by the use of a long open tank in which the complete post can be immersed. The tank is constructed either of wood or of steel, according to the way in which the equipment is to be used. If it is to be employed for the cold bath alone, then it can be constructed of wood throughout, as shown in Fig. 3, the heating of the bath to 90° F. being secured by the addition of quantities of heated creosote, &c. On the other hand, if it is desired to use the tank for both hot and cold baths, then it is impossible to use this construction unless steam heating from a traction or other boiler is available. An alternative construction uses framing-quality timber and a soldered galvanized-iron lining. Where only direct heating is available the tank is constructed of iron plate.

For the treatment of boards and scantling a tank of this description 18 ft. long is of the greatest value on the farm. The handling of the material is greatly facilitated by the provision of some form of overhead gear whereby posts, timbers, &c., may be loaded and unloaded in cages into the tanks. This is a matter best left to the ingenuity of the operator. A handy arrangement for the handling of small quantities of timber consists of a number of wire ropes. One end of each rope is attached to one side or other of the tank, the other end remaining free. By laying these wires across the tank the timbers may be raised or lowered at will, as shown in Fig. 4. In a similar manner a number of iron or wood straps are required to keep the wood below the surface of the preservative.

Unless covers are provided the tank should be deep and narrow rather than shallow and wide. An adequate drainage-platform or tank economizes the use of the preservative. It is a necessary adjunct to the simplest plant, even with the brush treatment, where swabbing is preferable to mere painting. A portable plant operated on the co-operative principle by a number of farmers appears to be the most economical type of equipment for this work.

An 18 ft. tank similar to that shown in Fig. 4 costs approximately £20. In ⅛ in. iron the cost is approximately £30. Suitable substitutes will naturally suggest themselves to the farmer. Old boilers, water-troughs, hydraulic piping, and other such articles have all been pressed into the service of the wood-preserver.

OPERATION OF PLANT.

The Forest Service has investigated the non-pressure treatment of fencing-posts cut from the thinnings of various species growing in the Rotorua plantations, but the tests have in most cases been too

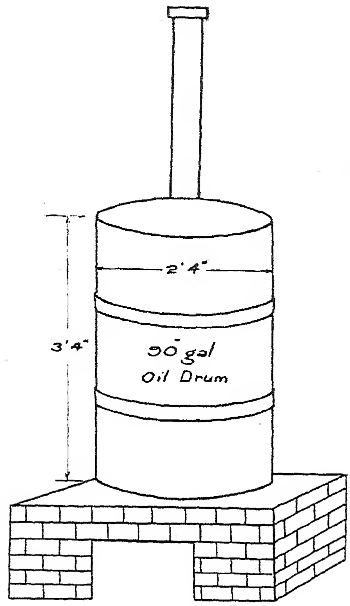


FIG. 2. OPEN TANK FOR BUTT TREATMENT. (DIAGRAMMATIC ONLY.)

A fire-trench in the ground can be used in place of the brickwork, as described in the text.

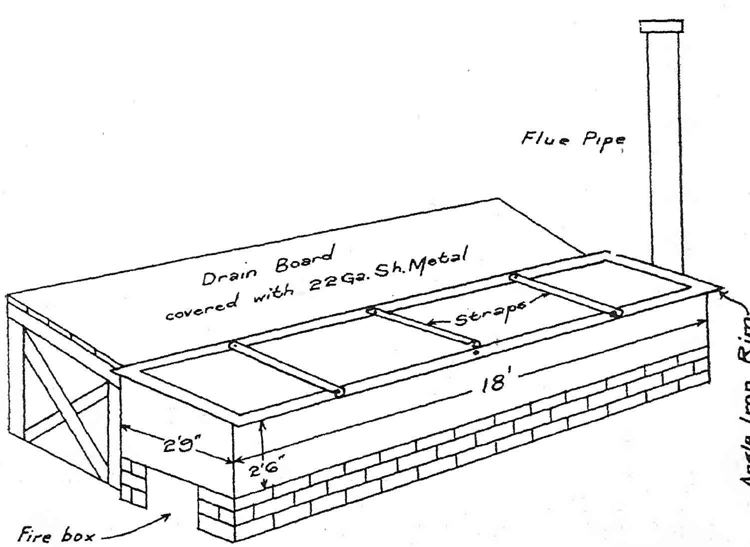


FIG. 3. LONG OPEN TANK FOR FULL-LENGTH TREATMENT. (DIAGRAMMATIC ONLY.)

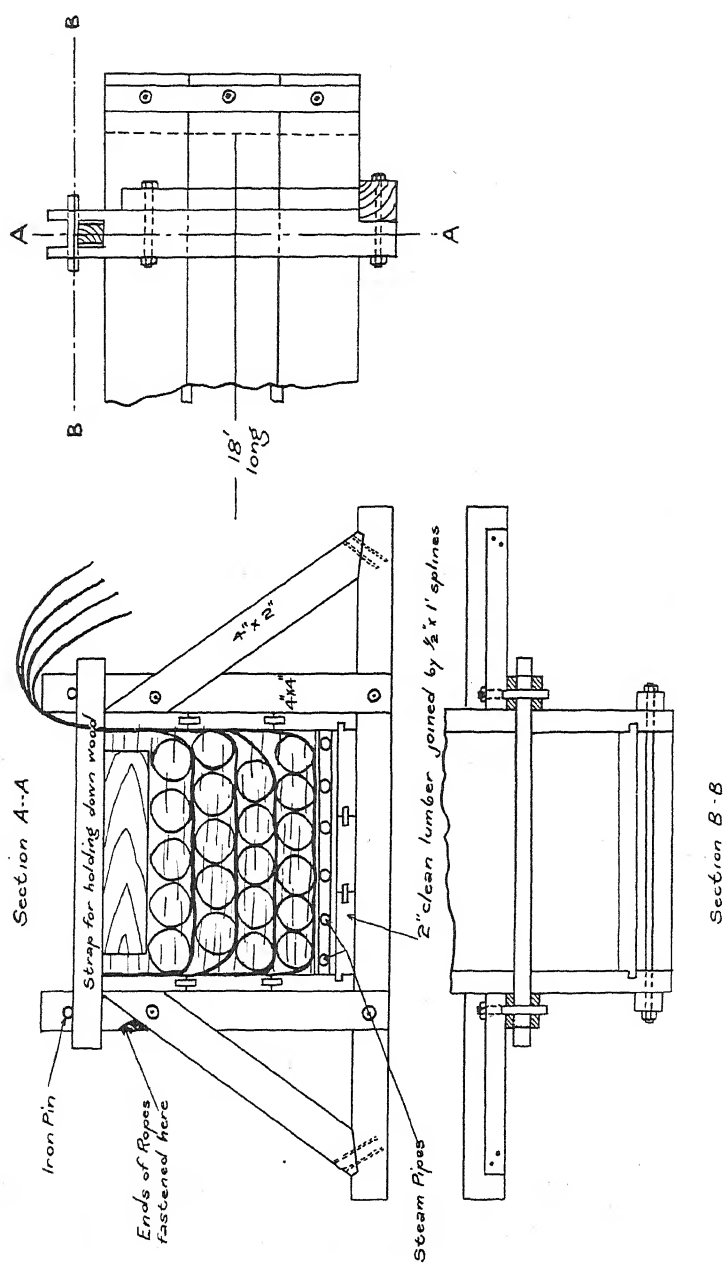


FIG. 4. SECTION OF LONG WOODEN TANK.

few in number to allow any final conclusions to be drawn. The work was done in co-operation with a Wanganui firm—New Zealand Coal-tar Products (Limited) – which donated a quantity of creosote corresponding to Grade 2 of the American Wood-preservers' Association's specification.

For general guidance Table 2 has been drawn up to give an indication of the treatment required by various woods, but frequent tests of penetration and absorption are necessary to adapt the treatment to the varying physical characteristics of the wood. In the case of the more porous woods, such as *Pinus radiata* and *P. muricata*, the times of treatment may possibly be considerably shortened.

Table 2.—Open-tank Treatment of Exotic Timbers.

Species.	Butt.		Top.	
	Hot Bath.	Cold Bath.	Hot Bath.	Cold Bath.
	Hours.	Hours.	Hours.	Hours.
Pinus Murrayana	1	1	..	1
P. muricata	1	2	..	2
P. pinaster	1½	3	..	3
P. radiata	1½	3	1½	1
P. Laricio	1½	3	..	1
P. Austriaca	2	4	2	4
Larch (on two successive days)	8	16	8	16
Eucalypts	2½	3	2½	3

P. Austriaca was the most difficult of the pines to treat. Larch was difficult to impregnate, and the results indicate that the English practice of two series of hot and cold baths of eight and sixteen hours respectively are required for effective treatment. All the eucalypts examined, including *E. ovata*, *E. risdoni*, *E. coriacea*, and *E. amygdalina*, required approximately the same treatment. Stephens (6) finds that other eucalypts respond to this treatment.

Absorptions are best measured by weighing sample posts before and after treatment, and penetrations by drilling auger-holes several days after treatment, as the creosote has a tendency to spread even after extraction from the cold bath. The auger-holes require to be stopped with creosoted plugs. The treatment must be varied until the desired absorptions and penetrations are obtained. If the penetration is not sufficient, either the hot or the cold bath should be lengthened; whereas with a satisfactory penetration accompanied by too heavy an absorption the cold bath should be shortened. To secure the best results the temperature of the hot bath should increase slowly up to the maximum. Fluctuations of temperature should be avoided.

For those timbers requiring the same treatment in both butt and top the posts are completely immersed for both the hot and cold baths. Where the top requires a cold bath alone, only the butt is given a hot bath, the whole post being later immersed in the cold bath. Sometimes, as in *Pinus radiata*, the top requires a shorter cold bath than the butt. This is conveniently secured if the depth of the long tank is sufficient to allow the post to be stood upright at the end of the

period required for the treatment of the top. Any of these treatments can be secured by the use of the round or long flat tanks such as are shown in Figs. 2 and 3.

Particular care is necessary to prevent creosote spilling over on to open fires, with consequent loss of posts and equipment.

CARE OF TIMBER AFTER TREATMENT.

Treated timber requires careful handling so that the treated envelope of wood remains unbroken. Exposure of any untreated wood, either by cutting or by accident, should be remedied by applying several coats of hot preservative. If posts are not used immediately after treatment they should be piled well off the ground—in close piles if completely treated, but in open piles if only the butt has been preserved.

In setting the posts the heavily treated butt portion should extend at least 6 in. and if possible 12 in. above the ground.

EXTRA LIFE DUE TO TREATMENT.

Unfortunately, there are few authoritative records available regarding the relative durability of treated and untreated fence-posts in New Zealand. The New Zealand Railways creosoted a large number of rimu and white-pine sleepers over twenty years ago, and many of them lasted for as long as fourteen years, the chief cause of removal being mechanical failure rather than decay. Bradley (5) has also treated *Pinus radiata* with good results. Weiss (7), one of the recognized American authorities on the subject of wood-preservation, has estimated the life of treated and untreated posts as follows: Untreated, five years; brush-treated creosote, nine years; dipped creosote, eleven years; impregnated with creosote, twenty-one years. The records of the German Post and Telegraph Department over a period of fifty years show that creosoted pine poles have an average life of 20·6 years.

COST AND VALUE OF TREATMENT.

The chief item of cost in the treatment of fencing-posts is the preservative. The average range of prices in the main New Zealand centres for the principal preservatives purchased in bulk is as follows, the lower values referring to locally made products, the upper to imported materials: Creosote, 1s. 6d. to 3s. per gallon; carbolineum, 2s. 6d. to 5s. 6d. per gallon; low-temperature creosote, 1s. 6d. to 7s. 6d. per gallon. Freight charges to the farm make the cost somewhat higher.

The cost of applying the preservative is difficult to estimate, as opportunities of using labour already employed, cost of fuel, &c., all require consideration. Operating under the most exacting conditions as regards the allocation of costs, it is not likely that they will amount to more than 3d. per post.

The amount of creosote absorbed varies with the species and the treatment. Table 3 has been prepared to show the volume of preservative absorbed by various-sized posts, adopting a minimum penetration of 1 in., and a minimum absorption for pines, larch, &c., of 20 lb. per cubic foot of treated wood for the butt portion and of

10 lb. per cubic foot for the top portion, and for eucalypts of 10 lb. per cubic foot for the whole post. All posts are 6 ft. in length.

Table 3.—Volume of Treatable Wood and Amount of Creosote absorbed per Post.

—	Minimum Penetration.	Average Absorption in Pounds per Cubic Foot.	Diameter of Post.			
			4 in.	5 in.	6 in.	7 in.
	Inches.					
Volume of treatable wood ..	1	..	..	..	..	..
Cubic feet	..	..	0·4	0·5	0·65	0·8
Absorption by pines ..	1	15	..	..	..	..
Gallons	..	..	0·6	0·8	1·0	1·2
Absorption by eucalypts ..	1	10	..	..	..	..
Gallons	..	..	0·4	0·5	0·65	0·8

Example 1: Given that *Eucalyptus ovata* posts can be cut and delivered from the farm plantation for 6d. per 5 in. post, and that creosote is delivered for 1s. 8d. per gallon, estimate the total cost of a treated post using the above-quoted minimum penetrations and absorptions—

	s. d.	s. d.
Cost of post delivered at plant		0 6
Cost of treating—		
Labour	0 3	
Creosote (volume equals ½ gallon, costing 10d.) ..	0 10	
		1 1
Total		1 7

RELATIVE COSTS AND SERVICE CHARGES.

The fundamental problem of farm economics is that of investment, and in choosing between treated and untreated posts an analysis of the relative investment costs based on compound-interest calculations is necessary if sound judgment is to prevail. Comparisons are best made on the basis of annual service charges, which are determined by the sinking-fund method. These annual service charges represent the equal annual payments which at annual compound interest will provide for renewal at the end of the life of the post without any scrap value for the post. They are determined by the formula :—

$$\frac{CR\,(1 + R)^n}{(1 + R)^n - 1}$$ where C = final cost of post in place, R = rate of interest (5 per cent. = 0·05), n = life of post in years.

Table 4 has been compiled from this formula to show the annual service charges on a post costing 1s. set in place, with interest at 5 per cent. The table may be applied to give annual service charges on posts of other values by simple multiplication.

Example 2: What is the annual service charge for a post costing 1s. 7d. treated, *plus* 1s. to set (see previous example), and having an estimated life of fifteen years? Table 4 shows that the annual service charge for a post with a life of fifteen years and costing 1s. set in place is 0·097s.

Table 4.—Annual Service Charges on Posts costing 1s. in Place. Interest at 5 per Cent.

Computed from the formula :—

$$\frac{CR\,(1 + R)^n}{(1 + R)^n - 1}$$ where C = final cost of pole in place, R = rate of interest (5 per cent. = 0·05), n = life of post in years.

Life in Years.	Annual Cost.	Life in Years.	Annual Cost.	Life in Years.	Annual Cost.
	s.		s.		s.
1	1·050	11	0·121	21	0·078
2	0·504	12	0·113	22	0·076
3	0·367	13	0·107	23	0·074
4	0·282	14	0·101	24	0·073
5	0·231	15	0·097	25	0·071
6	0·197	16	1·092	26	0·070
7	0·173	17	0·089	27	0·069
8	0·155	18	0·086	28	0·067
9	0·141	19	0·083	29	0·066
10	0·130	20	0·080	30	0·065

The annual service charge for a post costing 1s. 7d. in place is 0·097 × 2·6, equals 0·252s., or approximately 3d.

By estimating the initial costs and lives of the treated and untreated posts and determining their annual service charges a fair approximation of the economics of the problem may be obtained.

Example 3 : Ascertain if the treated *Eucalyptus ovata* post of the two previous examples is cheaper to use than a totara post costing 3s. with an estimated life of thirty years.

	Totara.	*E. ovata.*
	s. d.	s. d.
Cost of post	3 0	0 6
Cost of treatment	..	1 1
Cost of setting	1 0	1 0
Total cost	4 0	2 7
Life (years)	30	15
	0·065 × 4	0·097 × 2·6
Annual service charge	0·26s.	0·25s.

The *Eucalyptus ovata* is thus slightly cheaper to use.

CONCLUSIONS.

Preservative treatment makes available for fencing purposes many timbers hitherto regarded as unsuitable for such work. Other farm timbers may also be treated with advantage, a variety of preservatives other than creosotes being available for this class of treatment. Owing to the lower costs of these preservatives the economy to be effected in the treatment of such timbers is generally greater than can be attained with fencing-material. A further article will be contributed dealing with these methods of treatment.

APPENDICES.

(1.) BRITISH STANDARD SPECIFICATION FOR CREOSOTE FOR THE PRESERVATION OF TIMBER.

This specification covers the requirements of creosote suitable for the treatment of railway-sleepers and telegraph, telephone, and hangar poles.

Type A.

(1.) The material shall consist essentially of a distillate of coal-tar, and shall be free from any admixture of petroleum or similar oils.

(2.) The specific gravity shall be not less than 1·015 and not more than 1·07 at 38° C. (100° F.) when compared with water at the same temperature.

(3.) The material shall become completely liquid on being slowly warmed to 38° C. (100° F.) with stirring, and on cooling down shall remain completely liquid after standing for two hours at 32° C. (90° F.).

(4.) The amount of water in the creosote shall not exceed 3 per cent.

(5.) When 100 c.c. measured at 38° C. (100° F.) of the dry creosote are distilled from a 250 c.c. distillation-flask at such a rate that the distillation is complete in about twenty minutes, there shall distil at 760 mm. pressure—Up to 205° C. (401° F.), not more than 7 c.c.; up to 230° C. (446° F.), not more than 40 c.c.; up to 315° C. (599° F.), not more than 78 c.c.: the volume of all fractions being measured at 38° C. (100° F.). The residue above 315° C. (599° F.) shall be soft and not sticky, and its weight shall be not less than 22 grms.

(6.) The amount of tar acids shall be not less than 5 per cent. and not more than 16 per cent. by volume.

(7.) The amount of matter insoluble in benzol (benzene) shall not exceed 0·4 per cent. by weight.

Type B. Alternative for Scotch Creosote.

(1.) Scotch creosote shall conform to the above specification with the following exceptions:—

(2.) The specific gravity shall be not less than 1 at 38° C. (100° F.). In the case of the blast-furnace oil the specific gravity may be lower, but shall not be less than 0·940 at 38° C. (100° F.).

(3.) The distillate at 315° C. (599° F.) shall be not more than 85 c.c., and the residue not less than 15 grms.

(4.) There shall be no upper limit to the amount of tar acids.

(2.) AMERICAN WOOD-PRESERVERS' ASSOCIATION STANDARD SPECIFICATION FOR CREOSOTE OIL FOR TIES AND STRUCTURAL TIMBER FOR OPEN-TANK TREATMENT.

(1.) The oil shall be distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:—

(2.) It shall not contain more than 3 per cent. of water.

(3.) It shall not contain more than 0·5 per cent. of matter insoluble in benzol.

(4.) The specific gravity of the oil at 38° C. compared with water at 15·5° C. shall be not less than 1·03.

(5.) The distillate, based on water-free oil, shall be within the following limits:—

	Grade 1.	Grade 2.	Grade 3.
Up to 210° C., not more than ..	5%	8%	10%
Up to 235° C., not more than ..	25%	35%	40%

(6.) The residue above 355° C., if it exceeds 5 per cent., shall have a float test of not more than 50 seconds at 70° C.

(7.) The oil shall yield not more than 2 per cent. coke residue.

(8.) The foregoing tests shall be made in accordance with the standard methods of the A.W.P.A.

(3.) AMERICAN WOOD-PRESERVERS' ASSOCIATION STANDARD SPECIFICATION FOR HIGH-BOILING OR ANTHRACENE OIL FOR BRUSH OR SPRAY TREATMENT.

(1.) The oil shall be a pure distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements :—

(2.) It shall be fluid at 15° C. and crystal-free at 38° C.

(3.) It shall not contain more than 1 per cent. of water.

(4.) It shall not contain more than 0·5 per cent. of matter insoluble in benzol.

(5.) The specific gravity of the oil at 38° C. compared with water at 15·5° C. shall not be less than 1·09 nor more than 1·13.

(6.) The distillate, based on water-free oil, shall be within the following limits : Up to 235° C., not more than 2½ per cent. ; between 235° C. and 300° C., not more than 20 per cent. ; up to 355° C., not less than 50 per cent.

(7.) The residue above 355° C., if it exceeds 35 per cent., shall have a float test of not more than 50 seconds at 70° C.

(8.) The oil shall yield not more than 2 per cent. coke residue.

(9.) The foregoing tests shall be made in accordance with the standard tests of the A.W.P.A.

BIBLIOGRAPHY.

(1.) SHRIMPTON, E. A., Chief Engineer, N.Z. Post and Telegraph Department. Private communications.

(2.) CRAWFORD, J. M. Preservation of Wooden Poles. The Institution of Engineers, Australia, Proceedings, 1924.

(3.) HICKS, P. R. Service Tests of Butt Treated and Untreated Poles. Manual, American Wood-preservers' Association.

(4.) U.S.A. FOREST PRODUCTS LABORATORY. Technical Notes : F. 33, the Comparative Durability of Green and Seasoned Timber.

(5.) BRADLEY, ORTON, Charteris Bay, Lyttelton. Royal Commission on Forestry, 1913.

(6.) STEPHENS, H. B. Experimental Timber-preservation in South Africa. *South African Journal of Industries*, October, 1924.

(7.) WEISS, H. F. The Preservation of Structural Timber. 2nd ed., McGraw Hill, 1916, page 73.

COLLAR-ROT OF PEAS.

INCIDENCE OF THE DISEASE.

W. D. REID, Biological Laboratory, Wellington.

DURING the past four or five years a disease — now locally known as collar-rot—has become common in the pea crops of New Zealand, but apparently it was not until the 1924–25 season that it reached sufficient importance to warrant inquiry from seed merchants and growers. Evidence supplied by farmers indicates that the extent of diseased crops fluctuates from year to year, but the amount of damage which occurs during any season shows the necessity for a thorough investigation into the cause.

Although the occurrence of an unhealthy condition of some crops has been known for some years, it was not until October, 1924, after an examination of a Wellington-grown crop of garden-peas which was suspected of being diseased, that a preliminary investigation was begun. Later, in November, specimens of affected plants were received from Marlborough and the Hutt Valley (Wellington), and inspection of

the crops grown for the vegetable-market and the seed trade shows that in New Zealand the disease is widespread. From these samples and from the crops examined it is known that the disease is present in the districts of Dunedin, north and south Canterbury, Marlborough, Nelson, and the Hutt Valley. This wide distribution means a considerable variation of soil and climatic conditions, but under no circumstances has the trouble been totally absent, although certain factors, which will be discussed in a subsequent paper, tend to lessen or increase the virulence of the disease. Similar diseased crops have occurred in other countries, particularly "stem-blight of peas" in the United States (1), but the literature available does not indicate clearly either the distribution or the importance of the disease.

SURVEY OF PEA-CROP AREAS.

In the early part of the season—October and November last—a survey of some of the pea-crop areas was undertaken, particular attention being paid to the crops of Marlborough, one of the important pea-growing districts in New Zealand. In this area and Canterbury the bulk of the crops are for seed purposes, whereas the crops of Dunedin, Nelson, and the Hutt Valley are mainly grown for the vegetable-market; but in all cases the early symptoms of the disease are similar, notwithstanding differences in soil, climate, and methods of sowing. The first signs of any variation from the normal growth is a yellowing of the culm, a condition which is considered by the growers as being due to excessive soil-moisture. This diseased appearance may occur at any time during the life of the plant, but it is most noticeable and more prevalent in the early spring, when the plant has attained to a height of 3 in. to 8 in. Although heavy and continuous rain or drought may give rise to this sickly nature of the crop, the condition, if disease is present, always persists after a return to normal soil-moisture content has been attained. Death of the plant does not necessarily occur, but the growth is seriously retarded, so much so in some cases that the total seasonal growth does not exceed 6 in. In some crops all the plants may be badly affected, while in others the seriously diseased plants may be confined to large or small areas throughout the fields; but in all the crops examined, comprising many examples of apparently healthy and diseased crops of the previously mentioned districts, the disease has been present. The extent of the disease may vary in effect from almost total destruction of the crop, as far as ultimate seed-yield is concerned, to an amount which is only noticeable by a detailed examination.

Inspection of the spring growth of the yellowed pea-plants showed that the roots and basal portion of the stems were decayed, a feature which has given cause for the local name collar-rot. Such plants are readily withdrawn from the soil, owing to the absence of healthy secondary roots. This decay, generally of a brown colour, may only affect the epidermal tissue of the root, but where conditions favour the growth of invading organisms the vascular system may be destroyed. In the first case the growth of the plant may not be appreciably retarded, but in the second, where the connection between the root and shoot may be completely rotted off, wilting of the plants results. Where the disease has not materially affected the conduction-vessels (the central core) the plant is often able to put forth a fresh

root-system, by which a moderate growth is obtained, but the life, growth, and usefulness of the new roots are subject to attack under the same conditions which influence the life of the original roots. The tap-root and secondary roots, when diseased, are destitute of root-hairs, and the root-nodules generally abundant on leguminous plants are absent.

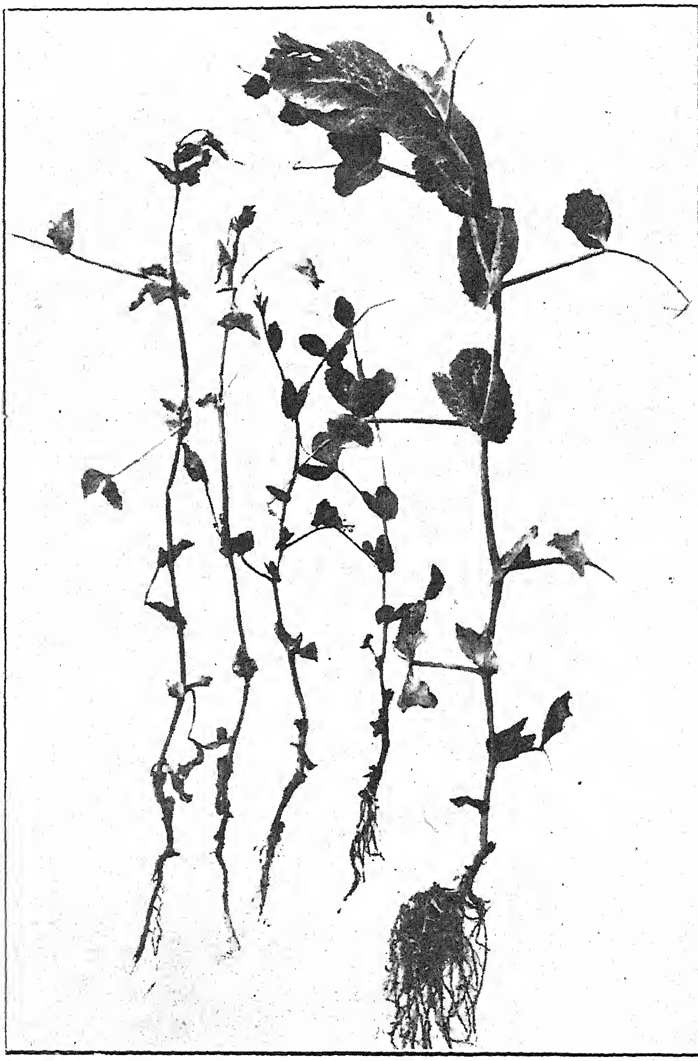


FIG. 1. SHOWING FOUR DISEASED PEA-PLANTS ON LEFT AND HEALTHY PLANT ON RIGHT.

Healthy plant was sown from same line of seed and at same time as diseased plants.

[*All photos by H. Drake.*

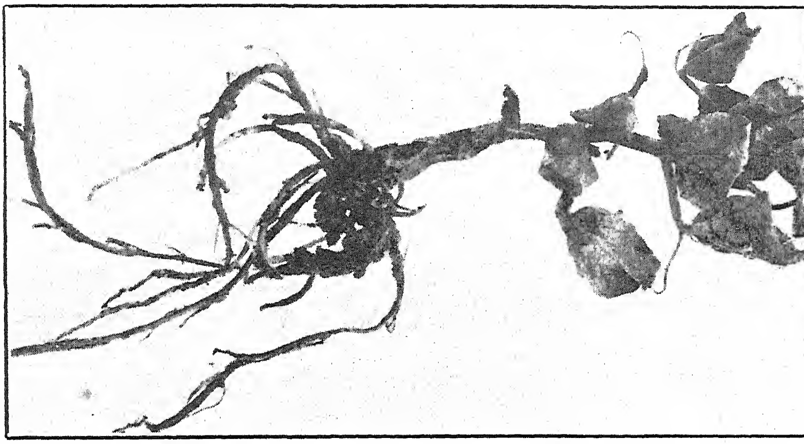


FIG. 2. SHOWING NEW ROOT-SYSTEM AND OLD TAP-ROOT ROTTED OFF.

Later seasonal examinations have shown that in those crops where the wilting was extensive in the spring the yellow condition has persisted and the growth has remained stunted. Needless to say, the seed-production from such crops is negligible, and it is not an uncommon practice to feed them off with sheep.

In addition to the above-mentioned features of the disease other symptoms appear which at first apparently have no connection with the early stages. At the time of flowering and setting of the seed—and this may occur on plants which have not shown any indication of previous wilting—dark brown and grey spots of $\frac{1}{8}$ in. to $\frac{1}{4}$ in. in diameter appear on the leaves and petioles. On the culms occur similar blue-black oval lesions, varying in size from $\frac{1}{2}$ in. in length to

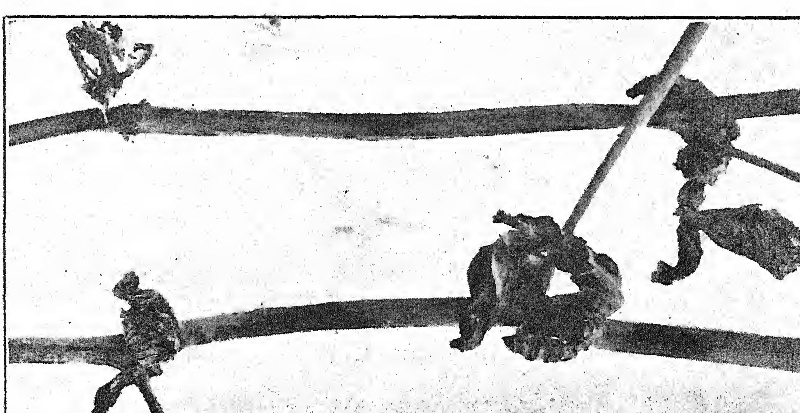


FIG. 3. LESIONS ON CULM OF PEA-PLANT.

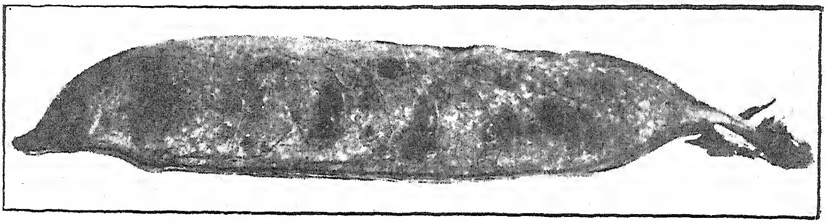


FIG. 4. PEA-POD ATTACKED BY THE DISEASE.

areas covering the greater portion of the culm. Only where the stems are subjected to very moist conditions does the staining of these lesions penetrate far into the tissue of the stems, the usual effect merely being a darkening of the cortex. The pods are often affected in the same manner, showing grey and brown spots, varying in size from small pin-points to patches covering the greater portion of the pod, or more often being small raised disks of $\frac{1}{16}$ in. to $\frac{1}{8}$ in. in diameter. Where the pods are more or less covered with these spots the husk is stained internally, and the seed may have a similar brown stain. The presence of lesions on the leaves, culms, and pods, and the staining of the seed, do not have any serious effect, if any, on the host, but the condition under which they occur and the relationship to the disease of the spring growth will be more fully discussed in a later article.

ECONOMIC IMPORTANCE OF THE DISEASE.

The New Zealand agricultural statistics (2) include the data regarding peas and beans under the one heading, but, assuming that the proportion of beans sown in the years previous to 1915 has not altered greatly in recent years, then the acreage of peas can be estimated by reducing the following totals by 17 per cent.: 1915–16, 9,359 acres; 1916–17, 11,905 acres; 1917–18, 11,685 acres; 1918–19, 17,929 acres; 1919–20, 14,416 acres; 1920–21, 14,466 acres; 1921–22, 12,789 acres; 1922–23, 24,449 acres; 1923–24, 18,676 acres.

Although a reduction of 17 per cent. of the foregoing acreages may be approximately correct in the case of the pea crops for threshing, it is doubtful if a similar reduction of the total values will give a true estimate of the value of the pea crop. Following is the estimated combined value of peas and beans for the past ten years: 1915–16, £49,978; 1916–17, £82,113; 1917–18, £125,033; 1918–19, £151,785; 1919–20, £166,188; 1920–21, £142,158; 1921–22, £135,759; 1922–23, £261,580; 1923–24, £136,045.

These values and acreages do not include the crops grown for the vegetable trade, of which the Wellington City market alone consumes about £5,000 each year.

Literature (2) (3) dealing with similar diseases in America and Europe does not give reliable estimates of the proportion of loss apart from stating that they are considered a serious trouble in connection with the canning industry. It is difficult to estimate the amount of damage caused by collar-rot in New Zealand, but when it is considered that all garden-pea varieties are more or less susceptible to

the disease, which under suitable conditions may partially or completely ruin the crops, it is evident that the trouble is of decided economic importance, calling for further investigation. Further, the loss sustained is not confined solely to those crops which are a total failure, but varies according to the virulence of the disease, so that a removal of the cause would not only obviate the complete failures, but also improve the growth and average yield of what are regarded as satisfactory crops.

Results of field examinations, life-history of the casual organism, and control measures will be dealt with in subsequent articles.

LITERATURE CITED.

(1.) JONES, F. R. Stems and Root-rot of Peas in the United States caused by a Species of Fusarium. *Journal of Agricultural Research*, vol. 26, pp. 459–476. 1923.
(2.) Statistical Report on the Agricultural and Pastoral Production of the Dominion of New Zealand, 1923-24.
(3.) VAN HOOK, J. M. Blighting of Field and Garden Peas. *Ohio Agricultural Experiment Station Bulletin* 173, pp. 233–246, 1906.

TESTING OF PUREBRED DAIRY COWS.

JANUARY TO MARCH C.O.R. LIST.

W. M. SINGLETON, Director of the Dairy Division.

DURING the first quarter of the present calendar year some forty-six cows received certificates under the certificate-of-record system, details of their performances appearing in the appended list.

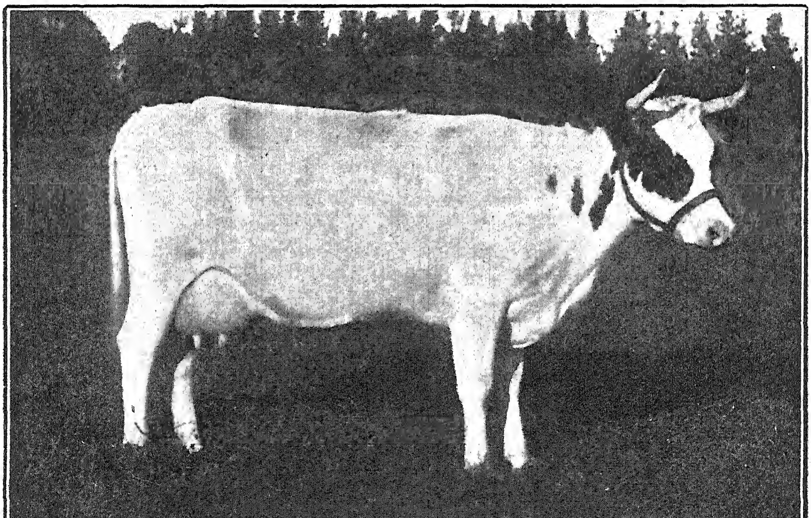
Perhaps the most creditable performance noted in the list is that of the junior two-year-old Ayrshire, Fair Maid of Greenbank, owned and tested by Mr. W. Moore, of Homebush, Masterton. Commencing test at the age of 2 years 27 days, she has gained a C.O.R. for 673·56 lb. butterfat. This entitles her to the leadership of the two-year-old Ayrshires, displacing Mr. W. Hall's Dimple of Edendale (529·46 lb. fat, on a record commenced at 2 years 327 days). Fair Maid of Greenbank is the only tested daughter of Brown Boy of Riki. Her dam is Bright Smile 4th of Greenbank (also owned and tested by Mr. Moore), who has qualified for certificate of record on a yield of 519·62 lb. fat at 2 years 21 days. Records such as these are doing much to bring the Ayrshire breed to that place which it deserves among our special-purpose dairy breeds.

Among the Friesians the highest yield here recorded is that of Dominion Jocrest, who was bred and tested at the Central Development Farm, Weraroa. Her production of 692·70 lb. butterfat was made under twice-a-day milking and practically average farm conditions during the whole period. This is the fourth consecutive lactation on which Dominion Jocrest has qualified for a first-class C.O.R. Her sire is the imported Woodcrest Joe, sire of nineteen C.O.R. daughters,

all of whom have gained their certificates on records made at the Central Development Farm. The dam of Dominion Jocrest is Dominion Julia de Kol, a certificated daughter of Sir de Kol Inka Pietertje (imp.), who is sire of sixteen C.O.R. daughters.

The highest record in the Jersey section is that of the senior two-year-old Holly Oak Sister Sue, with 671·76 lb. butterfat. This heifer was tested by Mr. R. Weinberg, of Nihoniho, and bred by Mr. John Hale, New Plymouth. The pedigree of Holly Oak Sister Sue is a particularly strong one, especially on the male side. She is closely related to such proven sires as Soumise Tom, Sunflower's Perseus (both champion butterfat bulls), Molina's General, Soumise Majesty, and Campanile's Sultan. Sultan's Daisy—968·22 lb. butterfat—at one time New Zealand's champion C.O.R. Jersey cow, appears twice on the sire's side and four generations back.

In this list appears the record of the Red Poll cow Wayward 6th B. No. 1, who was bred by Sir R. Heaton Rhodes, Otahuna, Tai Tapu. She was owned and tested by Mr. G. S. Young, West Plains, Southland, and has the distinction of being the first privately owned Red Poll to qualify for a C.O.R., all previous certificates for this breed having gone to the Central Development Farm herd, Weraroa. Wayward's record of 511·42 lb. butterfat is not only a Red Poll class-leadership, but is the highest C.O.R. yet awarded to a representative of the breed in New Zealand. Mr. Young is to be congratulated on the result of his first year's C.O.R. testing.



FAIR MAID OF GREENBANK (W. MOORE, HOMEBUSH).

C.O.R. in Ayrshire two-year-old class: 12,281·3 lb. milk, 673·56 lb. butterfat.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fairfield Rosette ..	R. Maddren, Winchester ..	1 360	240·5	344	8,095·0	424·40
Middlewood Ruth ..	Kilgour and Gibson, Kiwitea	2 38	244·3	308	6,166·9	346·10
Princess Rosebud ..	C. Care, Cambridge ..	2 47	245·2	317	5,486·3	329·52
Senior Two-year-old.						
Holly Oak Sister Sue†	R. Weinberg, Nihoniho ..	2 138	254·3	365	11,764·7	671·76
Victoria Regia* ..	F. J. Finer, Ngutuwera ..	2 107	251·2	365	13,042·7	643·61
Alfalfa Sweet Heather	F. J. Saxby, Hamilton ..	2 318	272·3	364	8,539·3	593·79
Jersey Park Fairy ..	W. Pollock, Hawera ..	2 156	256·1	365	7,751·0	475·55
Rosemont Princess Royal	E. L. Roose, Pukekohe ..	2 94	249·9	365	7,740·6	381·59
Bilberry's Bright Eyes	K. Rothe, Riverlea ..	2 326	273·1	365	7,567·6	365·48
Molina's Lady Violet	G. L. Lewis, Fendalton ..	2 350	275·5	365	6,284·4	341·09
Maori Flower ..	G. L. Lewis, Fendalton ..	2 306	271·1	292	6,262·7	334·56
Three-year-old.						
Camelia's Choice ..	A. J. Smith, Cardiff ..	3 106	287·6	365	9,180·8	554·61
Four-year-old.						
Irene's Goldie ..	A Buchanan, Palmerston North	4 18	315·3	365	10,224·1	602·64
Awatane Portia ..	J. Nicholson, Manakau ..	4 7	314·2	365	10,796·8	527·18
Fairview Magpie ..	Dr. G. Walker, Maunu ..	4 104	323·9	365	8,855·2	441·11
Mature.						
Countess of Concord ..	C. Waterhouse, Waverley ..	7 19	350·0	365	10,848·25	581·51
Lemon Blossom ..	A. A. White, Auckland ..	5 105	350·0	365	7,698·75	493·35
Capsicum's Ladylike	C. A. Willis, Pukekohe ..	6 45	350·0	365	9,794·0	482·81
Rewa Saint ..	W. H. Booth, Carterton ..	5 99	350·0	360	8,062·5	426·67
Ena	G. L. Lewis, Fendalton ..	5 0	350·0	319	7,477·2	414·87
	FRIESIANS.					
Junior Two-year-old.						
Heroic Queen* ..	J. McAnulty, Ashburton ..	2 57	246·2	365	18,495·8	561·77
Waireka Hengerveld Pietje Pontiac*	A. M. Budd, Carterton ..	2 8	241·3	365	16,308·4	559·36
Taumata Abbekerk Cornella*	A. M. Budd, Carterton ..	2 40	244·5	365	13,658·3	525·77
Waireka Pietertje Posch*	A. M. Budd, Carterton ..	2 16	242·1	365	14,619·0	515·99
Rosevale Queen Isobel Triumph*	McDonald and Co., Dunedin	2 19	242·4	365	11,277·1	354·54
Junior Three-year-old.						
Springbank May Pontiac*	John Court, Ltd., Auckland	3 144	291·4	359	15,128·6	499·59
Ashlyn 49th* ..	R. A. Wilson, Turakina ..	3 58	282·8	351	12,692·2	479·06
Senior Three-year-old.						
Taumata Netherland Pietje Pontiac*	A. M. Budd, Carterton ..	3 355	312·5	365	16,595·5	488·04
Lady Dinkum Domino*	A. M. Budd, Carterton ..	3 307	307·7	294	10,745·1	395·03
Junior Four-year-old.						
Kittie Maid of Maplehurst*	R. A. Wilson, Turakina ..	4 54	318·9	274	12,182·0	365·22

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS—*continued.*						
Mature.		Yrs. dys.	lb.		lb.	lb.
Dominion Jocrest ..	Central Development Farm, Weraroa	6 298	350·0	365	22,568·5	692·70
Maud Fayne Johanna 2nd†	Voss Bros., Longburn ..	7 251	350·0	312	15,170·9	563·09
Lady Pietje Alcartra*	Bloomfield Farm Company, Wellington	5 39	350·0	365	15,688·1	458·09
Sunnycroft Pietertje*	A. M. Budd, Carterton ..	6 17	350·0	282	13,745·7	447·00
Dutch Cadilac Queen*	W. I. Lovelock, Palmerston North	5 52	350·0	350	11,124·2	381·30
AYRSHIRES.						
Two-year-old.						
Fair Maid of Greenbank*	W. Moore, Homebush ..	2 27	243·2	365	12,281·3	673·56
Mature.						
Fair Maid of Edendale	W. Hall, Lepperton ..	9 61	350·0	365	11,409·3	459·99
Ivanhoe Bessie* ..	A. M. Weir, Menzies Ferry	5 20	350·0	287	11,244·4	352·43
RED POLLS.						
Two-year-old.						
Wayward 6th B. No. 1*	G. S. Young, West Plains ..	2 188	259·3	365	11,228·0	511·42
Second-class Certificates.						
JERSEYS.						
Junior Two-year-old.						
Pine Bank Topsy ..	J. Meuli, Normanby ..	2 25	243·0	365	7,690·0	392·66
Pine Bank Mona ..	J. Meuli, Normanby ..	2 50	245·5	365	7,037·8	371·67
FRIESIANS.						
Junior Two-year-old.						
Lady Posch of Oakview†	Brown Bros., Matatoki ..	2 54	245·9	363	6,836·0	331·26
Carlyle Pietje Fobes†	Brown Bros., Matatoki ..	2 8	241·3	365	8,258·2	329·56
Junior Four-year-old.						
Ellerlea Monona Minto de Kol*	A. C. M. Finlayson, Kamo ..	4 34	316·9	365	15,996·7	603·18
Mature.						
Pauline Acme 3rd* ..	John Court, Ltd., Auckland	11 314	350·0	351	21,471·3	670·35
Ashlynn 24th† ..	Piri Land Company, Auckland	5 48	350·0	365	13,879·4	470·26

HONEY-GRADING STORE AT GREYMOUTH.

THE Greymouth Harbour Board has erected, at the request of the West Coast beekeepers, a grading-store for honey at Greymouth. The store has been approved in accordance with the regulations relating to the export of honey from New Zealand, and the permit to grade honey at Molan's Store, Thompson Street, Greymouth, formerly appointed under the above regulations, is now cancelled.

CLUB-ROOT IN TURNIPS.

TRIALS WITH "DISEASE-RESISTANT" VARIETIES IN OTAGO AND SOUTHLAND.

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin.

DURING the season 1923–24 field trials of several varieties of turnips claimed to be highly resistant to club-root were conducted in Otago and Southland. In the present article a brief description of the economic importance of this disease is given, together with a record of the observations made in connection with the trials. The occurrence of dry-rot disease in the same plots is also recorded incidentally. Where the general term "turnip" is used it is intended to include both soft and swede varieties.

The turnip crop may be regarded as the most important cultivated crop, apart from grass, grown in Otago and Southland, approximately 205,000 acres having been grown there during the season 1923–24. The value of the crop to the southern farmer lies in the comparative ease with which it may be grown, coupled with its relatively high yield and great utility as a winter feed for stock. Such features give it a leading place in the farming practice of the South rivalled by no other crop Consequently, when weather conditions, or the incidence of certain bacterial or fungoid diseases, or the attack of insects, are such as to reduce the yield per acre, such a visitation is a most serious one for the farmer, seeing that the successful wintering of his stock is to a large measure regulated by the success or failure of his turnips.

Turnip-growing was introduced into Otago and Southland by the early Scottish farmers who settled in that part of the Dominion. With increased settlement turnip-growing also increased, and each succeeding year saw larger areas laid down. With the increased acreages shorter rotations between turnip crops were evolved, this to a large measure accounting for the spread of various diseases. Also the common practice of purchasing turnips—a large portion of which are often infected with club-root—and feeding such roots on clean land is a common means whereby disease is spread from farm to farm. It is only by a realization of the danger of carrying out this practice that the farmer can hope to prevent the introduction of disease on his property. The position to-day is that in certain localities of Otago and Southland turnip-growing is, to say the best, a most precarious undertaking. A large number of farmers find that they can only grow turnips with great difficulty, that failure is more often likely to accrue than success, and, in short, that they have been forced to abandon turnip-growing as a reliable farm practice, thus being forced into growing less satisfactory substitutes.

The two chief diseases to which the turnip is susceptive in Otago and Southland are club-root or finger-and-toe (*Plasmidophora brassicae*) and dry-rot (*Phoma napo brassicae.*) In this article, however, only minor reference is made to the latter disease, the main observations being concerned with club-root.

No definite figures are available in regard to the annual loss experienced by farmers as a result of club-root infection, and it will be realized that such pecuniary loss will vary considerably with the seasons, being lower in a dry and higher in a wet one. Estimating the average yield of turnips over all classes of country in Otago and Southland as about 15 tons per acre, and giving those turnips a value of £1 per ton, it then follows that the gross value per acre works out at £15. According to official statistics 205,000 acres of turnips were grown in 1923–24 in those districts, thus representing a monetary value of approximately £3,075,000. Making a deduction from this sum of 15 per cent., estimated as the loss incurred by club-root infection — namely, £461,250 — it can at once be realized of what importance is the finding of some means of counteracting this disease. Including resultant losses directly due to the primary loss just indicated, the total amount would probably be brought well up to the million sterling mark.

PLAN OF THE EXPERIMENTS.

Seeds of the following varieties were submitted for trial: (1) Irvine's Purple-top swede, (2) Irvine's Green-top Yellow turnip, (3) Sutton's Hardy White swede, (4) Mein's Purple-top swede, (5) Mein's Green-top Yellow turnip, (6) Mein's Purple-top Yellow turnip, (7) Bangholm swede.

In planning the experiments it was realized that, as the infection of the different fields varied considerably, an endeavour would have to be made to obtain the same intensity of infection by sowing the trial seed along with a control in various portions of the fields. Accordingly the ordinary turnip-ridger was employed, each drill of the ridger sowing different seed. For example, one drill would sow Bangholm seed, and the other a commercial strain of turnip similar in qualities to Bangholm swede. When the drilling was completed the field consisted of alternate rows of Bangholm and commercial swede, so that the variety under trial and the control were as nearly as practicable subjected to similar conditions in so far as soil infection was concerned. This method was adopted in the case of each variety of seed under trial, commercial seed being used as a control, this being selected to conform as nearly as possible with the type of turnip under trial. The fields selected or trial were known to be infected with club-root.

When the crops were matured ½-chain strips of adjacent rows of trial and control turnips were examined microscopically for club-root and dry-rot. These ½-chain rows were also weighed. Double rows were taken in this manner at varying places of the fields. The results obtained from this preliminary investigation are given below, a commentary being made on each result :—

IRVINE'S PURPLE-TOP SWEDE.

Three trials of this variety were carried out, two at Gore Experimental Area and one on the property of Mr. W. Scott, Mataura.

Trial 1. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with Club-root.	Number of Roots infected with Dry-rot.	Percentage of Roots infected with Club-root.	Percentage of Roots infected with Dry-rot.	Weight of Roots examined.
							lb.
A	Irvine's Purple-top swede..	40	29	72·5	4	10·0	114
	Commercial swede ..	37	37	100·0	1	2·7	101
B	Irvine's Turple-top ..	32	17	53·1	1	3·1	111
	Commercial	39	32	82·0	4	10·2	120
C	Irvine's Purple-top ..	35	21	60·0	5	14·3	119
	Commercial	42	32	76·2	4	9·5	112
D	Irvine's Purple-top ..	45	19	42·2	2	4·4	111
	Commercial	42	11	26·2	2	4·7	89
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Purple-top ..	152	86	12	56·5	7·9	28 13
..	Commercial	160	112	11	70·0	6·2	26 13

In this trial, as will be noted, the infection of club-root in the ground was high. In the case of Plots A, B, and C, Irvine's seed showed superiority in club-root resistance over the commercial swede. In Plot D the position, however, was reversed. The infection of the swedes by dry-rot was slight, being about equal in both varieties.

2. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with Club-root.	Number of Roots infected with Dry-rot.	Percentage of Roots infected with Club-root.	Percentage of Roots infected with Dry-rot.	Weight of Roots examined.
							lb.
A	Irvine's Purple-top swede	23	11	..	47·8	..	56
	Commercial swede ..	35	24	1	68·5	4·1	85
B	Irvine's Purple-top ..	39	16	2	41·0	5·1	96
	Commercial	38	23	10	60·5	26·3	60
C	Irvine's Purple-top ..	49	26	2	53·0	4·0	132
	Commercial	48	33	3	68·7	6·2	115
D	Irvine's Purple-top ..	40	15	1	37·5	2·5	110
	Commercial	49	29	5	59·0	10·0	106
E	Irvine's Purple-top ..	38	15	3	39·4	7·8	118
	Commercial	39	21	2	53·8	5·1	95
F	Irvine's Purple-top ..	45	22	2	48·8	3·3	108
	Commercial	42	9	2	21·4	4·7	115
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Purple-top ..	234	105	10	44·8	4·2	26 3
..	Commercial	251	139	23	55·3	9·1	23 7

In this case, as in Trial 1, Irvine's swede showed superiority in regard to club-root resistance over the commercial strain in all but Plot F. Here the position was entirely reversed. On the whole, Irvine's was less infected with dry-rot than the commercial strain.

3. T. Scott's Farm, Mataura.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Purple-top swede	47	11	..	23·4	..	32
	Commercial swede ..	14	3	..	21·4	..	18
B	Irvine's purple-top ..	50	35	..	70·0	..	30
	Commercial	27	13	..	48·1	..	20
C	Irvine's Purple-top ..	37	30	..	81·0	..	25
	Commercial	38	34	1	89·5	2·6	25
D	Irvine's Purple-top ..	42	37	..	88·0	..	30
	Commercial	24	23	..	95·8	..	14
E	Irvine's Purple-top ..	45	35	..	77·8	..	26
	Commercial	17	11	..	64·7	..	16
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Purple-top ..	221	148	..	67	..	7 4
..	Commercial	120	84	1	70	0·8	4 13

In Plots A, B, and E the commercial swede used showed less infection than Irvine's This piece of ground was very badly infected with club-root, and a large number of misses occurred in the ½-chain lengths. Whether those misses were accountable to club-root or not is problematical, but it would appear that in the majority of instances such was the case. If so, a different result would most likely have been obtained, for it is noticeable that in the case of each plot a larger number of Irvine's than commercial swedes were examined, thus rendering Irvine's more likely of showing a higher percentage of infection. This crop was remarkably free from dry-rot infection.

Summary.

As a result of this trial, and taking into account the remarks made in connection with Trial 3 of this series, it would appear that Irvine's Purple-top swede shows a higher capability of resisting club-root than the commercial strains used. The same conclusion is arrived at in regard to its resistance to dry-rot.

IRVINE'S GREEN-TOP YELLOW TURNIP.

Three trials of this variety of soft turnip were made, two at Gore Experimental Area and one on Mr. Raynbird's farm, Otago Peninsula.

4. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Green-top Yellow turnip	36	17	4	47·2	11·1	69
	Commercial turnip ..	42	26	8	61·9	19·0	105
B	Irvine's Green-top Yellow	32	3	..	9·3	..	68
	Commercial	47	2	4	4·2	8·5	121
C	Irvine's Green-top Yellow	36	4	6	11·1	16·6	98
	Commercial	36	2	..	5·5	..	59
D	Irvine's Green-top Yellow	40	..	3	..	7·5	70
	Commercial	35	5	14	14·3	20·0	113
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Green-top Yellow	144	24	13	16·6	9·0	19 4
..	Commercial	160	35	26	21·8	16·2	25 2

The infection with club-root was very light in all plots but A. In the case of Plots A and D the infection with dry-rot was greater than on the other plots. As will be noted, Plots A and B showed the greater percentage of infection with Irvine's turnip. The reverse was the case in Plots C and D. The averages show a higher percentage of club-root infection in the commercial turnip over Irvine's turnip. This also is the case in regard to dry-rot infection. It should be noted that the commercial turnips, despite the heavier infection, gave a heavier yield per acre.

5. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Green-top Yellow turnip	40	1	1	2·5	2·5	57
	Commercial turnip ..	57	2	10	3·5	17·5	106
B	Irvine's Green-top Yellow	30	..	..	..	..	74
	Commercial	36	..	7	..	19·4	105
C	Irvine's Green-top Yellow	33	3	1	9·1	3·0	50
	Commercial	44	13	4	29·5	9·1	76
D	Irvine's Green-top Yellow	35	3	3	8·6	8·6	45
	Commercial	46	10	6	21·7	13·0	90
E	Irvine's Green-top Yellow	38	2	..	5·3	..	55
	Commercial	41	9	4	22·0	9·7	70
F	Irvine's Green-top Yellow	33	1	1	3·0	3·0	32
	Commercial	38	9	1	24·0	2·6	98
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Green-top Yellow	209	10	9	4·3	4·1	13 2
..	Commercial	262	43	33	16·4	12·6	22 19

In this case Irvine's turnip showed a decided superiority in regard to club-root resistance, particularly where the incidence of infection in the soil was high. This also applies in the case of those turnips infected with dry-rot, with the exception of Plot F. As was the case in Trial 4, the commercial turnip gave the heavier yield per acre, notwithstanding its greater degree of infection. As will be seen in the averages, the incidence of disease in this trial was comparatively slight.

6. Mr. Raynbird's Farm, Otago Peninsula.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Green-top Yellow turnip	19	..	..	..	..	54
	Commercial turnip ..	36	4	4	11·1	11·1	67
B	Irvine's Green-top Yellow	43	..	..	..	..	53
	Commercial	45	2	3	4·4	6·6	59
C	Irvine's Green-top Yellow	41	2	2	4·8	4·8	50
	Commercial	26	10	13	38·4	5·0	42
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Green-top Yellow	103	2	2	1·9	1·9	13 2
..	Commercial	107	16	20	15·0	18·7	14 3

Club-root infection in this trial, also dry-rot infection, were distinctly more pronounced in the case of the commercial turnip. Again, however, it is noticeable that the recorded yield per acre of commercial turnips was higher than that recorded for Irvine's.

Summary.

From the three trials of this variety distinct indication is given that Irvine's turnip has a greater degree of resistance to both club-root and dry-rot than the commercial strains used. This is particularly noticeable in the case of Trials 5 and 6. The yield per acre of Irvine's turnips was lower in each case when contrasted with the commercial turnip, but as the value of a turnip is to a large measure regulated by its keeping-quality it would appear that the disadvantage of a comparatively low yield in the case of Irvine's is more than compensated by the lesser percentage of infection throughout the crop.

SUTTON'S HARDY WHITE SWEDE.

Two trials of this variety were conducted, one at Gore Experimental Area, and the other on Mr. Raynbird's farm, Otago Peninsula.

7. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Sutton's Hardy White swede	33	11	3	33·3	9·1	53
	Commercial swede ..	30	19	..	63·3	..	30
B	Sutton's Hardy White ..	31	4	3	12·9	9·7	63
	Commercial	32	22	2	68·7	6·2	67
C	Sutton's Hardy White ..	35	7	6	20·0	17·1	68
	Commercial	38	27	3	71·0	7·9	72
D	Sutton's Hardy White ..	45	38	4	84·4	8·8	60
	Commercial	42	36	3	85·7	7·1	58
E	Sutton's Hardy White ..	29	24	3	82·8	10·3	45
	Commercial	23	22	4	95·7	17·4	22
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Sutton's Hardy White ..	173	84	19	48·6	11·0	14 10
..	Commercial	163	127	12	77·9	7·3	12 10

In all plots but one, Sutton's seed here showed a slight superiority over the commercial seed in so far as club-root infection was concerned. The reverse was the case in regard to dry-rot infection. Both varieties were badly infected by club-root and showed little resistance to the disease.

8. Mr. Raynbird's Farm, Otago Peninsula.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Sutton's Hardy White swede	30	16	..	53·3	..	50
	Commercial swede ..	33	15	1	45·5	3·0	48
B	Sutton's Hardy White ..	25	23	1	92·0	4·0	68
	Commercial	27	25	4	92·6	14·4	67
C	Sutton's Hardy White ..	32	17	2	53·1	6·2	52
	Commercial	41	19	6	46·3	14·6	56
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Suttod's Hardy White ..	87	56	3	64·3	4·4	14 5
..	Commercial	101	59	11	58·4	10·9	14 8

As in Trial 7, both varieties were heavily infected with club-root, Sutton's swede, if anything, the more so. The percentage of dry-rot present was comparatively low, showing in favour of Sutton's swede. The yield per acre in this case was practically equal for both varieties.

Summary.

On viewing the results of this trial one is forced to conclude that Sutton's variety has no claim to be resistant to club-root disease. Plot B of Trial 8 showed that where the disease was severe in the field this swede became badly infected.

MEIN'S PURPLE-TOP SWEDE.

One trial only was made with this variety—namely, at Gore Experimental Area, as follows :—

9. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Mein's Purple-top swede ..	34	23	4	67·6	11·8	75
	Commercial swede ..	34	30	3	88·2	8·8	72
B	Mein's Purple-top ..	36	19	5	52·7	13·8	94
	Commercial	35	34	11	97·4	31·4	72
C	Mein's Purple-top ..	33	20	6	60·6	18·2	85
	Commercial	41	37	6	90·2	14·9	72
D	Mein's Purple top ..	37	21	2	56·7	5·4	67
	Commercial	42	38	4	90·5	9·5	76
E	Mein's Purple-top ..	28	16	1	57·1	3·5	75
	Commercial	31	27	2	87·1	6·4	66
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Mein's Purple-top ..	168	99	18	58·9	10·7	20 19
..	Commercial	183	166	26	90·7	14·2	18 1

Mein's seed showed a superiority in regard to disease-resistance in so far as club-root disease was concerned. In regard to dry-rot the results were variable, in some instances the control swedes proving superior. Neither variety showed a high degree of resistance, and the claim made in connection with Mein's seed cannot be regarded as fully substantiated from the observations made in this trial.

MEIN'S GREEN-TOP YELLOW TURNIP.

A single trial of this variety was conducted on Mr. Irvine Martin's farm, Gore, results being as follows :—

10. Mr. Irvin Martin's Farm, Gore.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Mein's Green-top Yellow turnip	44	2	2	4·5	4·5	40
	Commercial turnip ..	43	..	2	..	4·6	46

Trial 10—continued.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
B	Mein's Green-top Yellow ..	45	6	4	13·3	8·8	36
	Commercial	41	..	..	..	..	40
C	Mein's Green-top Yellow ..	42	2	2	4·7	4·7	28
	Commercial	27	..	3	..	11·1	22
D	Mein's Green-top Yellow ..	48	1	2	2·1	4·2	36
	Commercial	35	..	3	..	8·5	26
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Mein's Green-top Yellow ..	179	11	10	6·1	5·6	8 9
..	Commercial	146	..	8	..	5·5	8 16

As will be noted, Mein's turnip showed no superiority over the commercial variety. The percentage of club-root infection in the field was low, and consequently the information tabulated is a poor index of the probability of this turnip's disease-resistant properties. It is particularly to be noted that none of the commercial turnips was infected with club-root, whereas 6·1 per cent of Mein's showed infection. In regard to dry-rot resistance both varieties showed equal infection.

MEIN'S PURPLE-TOP YELLOW TURNIP.

This variety was tested at the Gore Experimental Area, with results as tabulated :—

11. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Mein's Purple-top Yellow turnip	54	8	5	14·8	9·3	41
	Commercial turnip ..	37	2	3	5·4	8·1	32
B	Mein's Purple-top Yellow	45	4	1	8·8	2·2	40
	Commercial	36	3	1	8·3	2·8	32
C	Mein's Purple-top Yellow	42	8	2	19·0	4·7	32
	Commercial	34	..	2	..	5·9	32
D	Mein's Purple-top Yellow	51	6	4	11·7	7·8	41
	Commercial	39	1	1	2·5	2·5	40
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Mein's Purple-top Yellow	192	26	12	13·5	6·5	9 14
..	Commercial	146	6	7	4·1	4·8	7 19

The commercial strain in this trial showed superiority in regard to club-root and dry-rot disease-resistance.

BANGHOLM SWEDE.

A trial of Bangholm swede was conducted at Gore Experimental Area on land known to be heavily infected with club-root. Three years previous to this trial the land had been limed with different quantities of burnt lime per acre, one strip being left as a control. Previous observations made on this block had indicated that as a means of control lime was of no great value. The following information is consequently of value not only in indicating the club-root resistant properties of Bangholm swede, but also in showing the effect of lime in relation to the disease. The tabulated statements explain the scheme of laying out the plots.

12. Gore Experimental Area.

Plot.	Variety.	4 Tons Burnt Lime per Acre.		8 Tons Burnt Lime. per Acre.		Control		16 Tons Burnt Lime per Acre.		2 Tons Burnt Lime per Acre.	
		Club-rooted.	Sound.	Club-rooted.	Sound.	Club-rooted.	Sound.	Club-rooted.	Sound.	Club-rooted.	Sound.
A	Bangholm swede ..	6	15	11	21	13	23	12	23	10	14
	Commercial swede ..	14	1	10	1	31	0	13	4	20	1
B	Bangholm	3	18	2	17	4	23	2	26	7	10
	Commercial ..	20	4	16	15	46	0	29	6	24	0
C	Bangholm	8	15	18	20	10	19	8	22	10	15
	Commercial ..	24	3	26	5	34	1	29	1	26	1
D	Bangholm	9	21	13	26	14	16	13	27	19	18
	Commercial ..	24	11	25	10	34	10	25	24	26	2

The figures represent numbers of roots, diseased or sound.

Variety.	4 Tons Burnt Lime per Acre.		Percentage of Infection.	8 Tons Burnt Lime per Acre.		Percentage of Infection.	Control.		Percentage of Infection.	16 Tons Burnt Lime per Acre.		Percentage of Infection.	2 Tons Burnt Lime per Acre.		Percentage of Infection.	Average Percentage of Infection over 5 Plots.
	Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		
Bangholm ..	26	69	27·3	44	84	34·3	41	91	31·0	35	98	26·3	46	57	44·6	32·7
Commercial ..	82	19	81·9	77	31	71·3	145	11	93·0	96	35	73·3	96	4	96·0	83·1

It will be noted that Bangholm swede showed a fair degree of disease-resistance in contrast with the commercial variety. The effect of the various applications of burnt lime appears to be negligible, and only emphasises the fact, as already stated in previous reports, that lime is not an efficacious remedy for the control of club-root.

GENERAL SUMMARY OF TRIALS.

(1.) The results so far obtained serve to pave the way for further experimentation, and indicate that where this class of work is being performed a large number of observations will have to be made to obviate the great variations which occur.

(2.) Insufficient roots were examined to eliminate any probable error in regard to the experiments.

(3.) Of the turnips submitted for trial none were immune to club-root disease.

(4.) Although a number of varieties showed a higher degree of resistance to club-root and dry-rot than the commercial varieties with which they were compared, it cannot be claimed that these varieties warrant the name of "disease-resistant"—all being fairly heavily infected.

(5.) Two varieties showed promise of being worthy of further trial under more exacting conditions, these being Bangholm swede and Irvine's Green-top Yellow turnip.

Thanks are due to those farmers who co-operated in carrying out the experiments. Mr. R. McGillivray and Mr. T. Pattinson, of this Department, both rendered valuable assistance in gathering the information.

A SIMPLE METHOD OF MAKING CONCRETE POSTS.

A FAIRLIE correspondent (R. E. G.) writes to the Editor as follows :—

"In your February issue there is an article on making concrete posts for farm-work in which the writer gives particulars for making the boxes, &c. Another method, which perhaps does not make such a neat post, but which answers very well, is as follows: Select a spot of old pasture with a good, firm sole of grass and solid subsoil—a patch of old twitch does very well. With a very sharp spade dig out a trench the size of the post required. If the ground is firm the sides will stand all right without boards or support. Then line the trench with stout tarred paper, old clean sacking, or other material to keep the concrete from the soil. Mix the concrete as directed, and put in the reinforcements as necessary. Before putting in the concrete I lay two or three pieces of No. 8 wire across the trench, and bend them to the sides as close as possible, leaving about 18 in. of wire projecting above the trench on each side. After the posts are made, cover with a wet sack or straw, or any waste material, to keep the sun and frost away, and leave for a month or more to mature. When the posts are ready the wires are brought together, twisted, and a crowbar or the like passed underneath. A couple of men can then lift the post out into a dray or cart. By leaving the posts in the ground they are kept damp and do not dry too fast in the sun or wind. Most farms have a creek or stream running through them, and there is generally good, old, firm ground on the banks that has not been ploughed. Often (as in my case) the shingle is in the creek and has been well washed ready for use."

London Market for Peas and Beans.—The following advice was cabled by the High Commissioner on 4th April :—*Peas*—Market dull. Partridge: New Zealand No. 1 sold at 65s. per 504 lb. ex store; Tasmanian quoted at 75s. to 82s. 6d. ex store, according to quality; English, good average, offered at 48s. to 50s. Blue: Dutch pressed for sale at low prices; no demand for New Zealand or Tasmanian. Nominal values are £16 and £18 per ton ex store respectively. *Beans*—Market dull. Good English spring offered at 53s. and winter at 47s. 6d. Chinese horse, spot, quoted at £10 10s. per ton ex store; new crop, July–September shipment, £9 17s. 6d.

SEASONAL NOTES.

THE FARM.

TOP-DRESSING OF PASTURE.

TOP-DRESSING should be carefully considered at this period, and arrangements made for the necessary supplies. Most grassland will greatly benefit by judicious top-dressing, but if the pasture is very deficient in clovers and contains much weed-growth it will be better, if possible, to renew it before spending money on top-dressing. As a general principle it is better to start top-dressing while the pasture is still in good condition, and thus preserve the good plants, rather than let them get weak and then try to restore them by means of manure. Nevertheless it must be recognized that even weak pastures are greatly benefited by top-dressing.

At one time it was generally considered the correct practice to apply heavy dressings and then let the land stand for several years, but recent experience goes to show that better results are obtained from lighter and more frequent applications, the ideal being to get the pasture in good heart and keep it in this condition by annual light dressings. If this practice is followed 2 cwt. per acre per year is ample, but if no top-dressing has been done for a few years, or if the pasture is very much run down, from 3 cwt. to 4 cwt. should be applied the first year, and followed up by lighter annual dressings.

Basic slag continues in great popularity in many districts, and at present prices is quite an attractive proposition under conditions favourable to its use. It suits heavy soils rather than light, moist conditions rather than dry, and old pastures rather than new. It is rather slower in action than super, but, given sufficient moisture, will take effect in a few weeks. Super is now used in increasing quantities for top-dressing, and is remarkably efficient on the lighter soils in particular, though valuable on clay soils also. In certain cases, however, it is found that to obtain the best results from super the soil must first have been limed; and where super is used it is a good general rule either to lime at regular intervals or to employ a mixture of lime and super. Various proportions may be used; it is best to mix three or four days ahead. Ground rock phosphate (Nauru, &c.) does well under certain conditions, but appears to depend for its effectiveness very largely upon a good supply of moisture and a certain amount of soil-acid. Hence it is unsuitable for dry soils, dry weather conditions, and land recently limed. A mixture of super and the ground rock in equal proportions is generally better than the latter used alone. On the poorer classes of land blood-and-bone gives excellent results, as also does bonedust on light open soils, but the cost of these two fertilizers is at present high, and money is better invested in super or slag, except under special conditions.

On certain soils, notably light sandy loams and peaty land, potash is generally a useful supplement to the usual phosphatic dressing. Kainit is often used for this purpose. It is a low-grade manure (14 per cent. potash), and is rather awkward to handle, but it has the virtue of

containing a large proportion of salt, which has a sweetening effect on land, and most pastures will benefit from an application of 2 cwt. to 3 cwt. per acre. When kainit is applied in conjunction with phosphatic fertilizers it is best to mix just before top-dressing.

Slow-acting phosphates (ground rock) should be applied in May; slag is best applied in June or July; and basic super or super in July or August. Before top-dressing, the pasture should be fed down fairly closely, and thoroughly tripod-harrowed afterwards. In order to obtain the maximum benefit from top-dressing, proper drainage must be provided. This also applies to liming.

There are reports of stock being injured by feeding on grassland immediately after it has been top-dressed, and for this reason it is better to keep the animals off for a week or so, or until there has been a good shower of rain.

ROOTS.

The mangold crop should be stored in May or June before frosts become severe. The usual method is to hand-pull the roots, twisting the tops off by a sudden jerk, while at the same time throwing the roots into rows four drills apart. They are then left to ripen for about a fortnight to three weeks before carting to the clamps. Pitting improves the feeding-value of mangolds; unless pitted they frequently cause scouring in stock. The heap should be covered with straw or piled under a plantation as a protection against frost. The roots are best arranged in shaped clamps, with the best-keeping varieties, such as Long Reds, at the end where they will be fed last. Where large areas are to be handled an implement made of two planks fixed together on edge in the shape of a V and drawn at the apex between every four drills facilitates harvesting. Although the mangold resists light frosts while standing in the ground, very little frost may cause considerable injury if the roots are left lying on the surface too long, as that portion of the root previously under the ground is tender.

Where necessary, or where the crop is showing signs of disease, the feeding-off of swedes can be commenced, together with a hay ration, using the poorest hay first. On heavy clay soils stock should be removed from the root breaks after heavy rain, otherwise the soil-texture may be spoiled. On this account swedes growing on heavy soils should not be fed off by cattle.

OAT-SOWING.

The coming month is a good period for sowing oats, especially crops intended for chaffing later. Sown then they provide considerable green feed during the late winter and early spring and ripen about New Year. In some districts this is an important point, as they can then be harvested before Californian thistle ripens its seed. In most spring-sown crops the thistle, where present, ripens about the same time as the oats. Algerians are generally best for autumn sowing, a suitable amount being about 2½ bushels to the acre, with 1 cwt. to 2 cwt. of super, according to the nature of the land.

Both oats and wheat should be treated with some reliable smut-preventive. Formalin or hot water treatments are those generally used in this country. Both hasten germination and cause the seed to swell and run slower in the drill, which requires setting to sow a larger quantity.

POTATOES.

Any mature potato crops still in the ground should be lifted before the land becomes sodden with winter rains. Digging should be done in good weather, and the tubers left on the ground for a few hours to dry before being placed in sacks. Corticium disease has been prevalent in some localities in the South. It has been present for many years, but appears to have become more virulent of late.

—*Fields Division.*

THE ORCHARD.

STORAGE.

All fruit appears to be maturing earlier than usual this season, and by the time these notes appear there will be only a few late varieties of pip-fruit to gather. As a general rule all fruit not intended for disposal immediately it has been gathered should be placed in cool storage if it is desired to keep it until after July or August. Sturmers, Rokewoods, Tasmas, and Lord Wolseleys will keep fairly well in ordinary storage, providing, of course, that they are left in a cool place. All fruit intended for keeping for any length of time should be free from blemish and skin-punctures.

BRANDING OF CASES FOR THE LOCAL MARKET.

It may be somewhat late in the season to give advice on branding cases for market. However, after the experience of inspection at the various markets during the past few months a few suggestions may benefit some who are as yet ignorant of the best methods to follow. Many growers act against their own interests through not placing on the ends of the case a few more particulars. One often comes across cases with only marks such as "K 147—1st Grade," or "L 678—2nd Grade." There is nothing to indicate what is contained in the case, whether apples or pears, or what variety. Buyers are left to find out for themselves, and the auctioneers are at a disadvantage. It is the grower who suffers every time when he fails to give a clear indication as to the value and quality of his fruit. It means very little extra trouble to give a few particulars on the case, either by means of a rubber stamp or a stencil. This facilitates selling, and often means better prices, and is altogether more satisfactory. The minimum particulars stamped on cases should be (1) the consignee's initials, (2) the consignor's registered number, and (3) the variety and size of the fruit. These are best grouped at the top, in the middle, and at the bottom respectively.

CULTIVATION.

The close of the picking season is a good time for ploughing the orchard. If cover-crops have been grown and these have not made sufficient growth the work may be delayed until a later period. All soils derive considerable benefit by being turned up to the winter frosts. When ploughing at this period provision should be made for the free drainage of water away from the trees. This is best done by turning the soil up to the trees and leaving a furrow down the centre

of each bay. When ploughing, every care should be exercised not to break branches from the trees or to unduly knock the trees about in any way. Likewise care should be taken not to plough too deeply near the trees, as this is likely to cause damage to the roots. For the purpose of ploughing close up there are now on the market suitable implements that enable one to practically cover all the land, except perhaps under very wide-spreading trees. These include ploughs with handles that will move to either side, and wide bridles which ensure that the horse walks some distance away from the trees. These are things worth considering, as hand-work in an orchard should be reduced to a minimum.

PRUNING AND GENERAL.

In some localities pruning will commence on stone-fruits during May, and it should always be pushed on with before the more severe winter weather sets in.

Steps should be taken to clean up the orchard at the end of the picking season, also to trim the fences, clean out the drains, and carry out the many other minor operations that are necessary to keep the place in good order. The first opportunity should also be taken of looking over the spray-pumps in readiness for next season's work. This is very necessary, in order that trouble may be avoided during the busy spraying season, when every hour is important.

—*L. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

Full attention should now be given to final harvesting of the autumn crop of lemons. There will then be little else of consequence needing attention in the grove, with the exception of the fungicidal sprays mentioned in last month's notes, if such have not already been applied. Those growers who intend to put their citrus areas into a cover-crop are advised to plant blue lupins as soon as possible for ploughing under in the early spring. The best means for sowing lupins between the rows is the ordinary farm drill, using from 5 cwt. to 10 cwt. of basic super to the acre with the seed.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

MANAGEMENT OF THE LAYING PULLETS.

THE pullets must, of course, be depended upon for the bulk of the eggs in the winter season, as even the desired late-moulting hens will be taking a rest for the purpose of renewing their feathers. Even pullets bred to lay in winter are apt to go into a moult at any time now if subjected to improper management. Every assistance should therefore be given them so that they may lay to their maximum capacity.

Good feeding is imperative at this period of artificially induced production. The morning and midday meals may consist of a mash made of one part finely ground good-quality wheatmeal to two parts

of bran, moistened with milk or meat-soup, or, failing these, boiling water. The mash should be mixed to a crumbly condition, not sloppy. Give as much as the birds will eat without waste; any left over should be removed and less given the following day. Where meat is available it should be fed separately in, say, the proportion of 1 oz. (cooked) to each bird daily. In the absence of boiled meat, meat-meal should be judiciously added to the morning mash—say, about 6 per cent. of the entire mixture; in addition it may be provided in a separate receptacle, so that the birds (usually the best layers) that crave for more of this forcing-material may be able to secure it. Where more than an odd bird or two becomes affected with ovarian troubles, such as protrusion of the oviduct, &c., or if many shell-less eggs are being produced, the animal food should be given in a less quantity, as it indicates that the forcing diet is being oversupplied. For the evening meal, when the price warrants use, a mixture of equal parts of wheat, short plump oats, and maize provides a suitable ration. Care should be taken, however, to observe the manner in which the birds relish the different grains. Where it is noted that they are leaving any particular grain this should be given in a reduced quantity. Of course, allowance must be made for the fact that fowls will often take some time to become accustomed to a new kind of food. All grains should be fed in deep litter as a means of providing the birds with ample exercise in scratching for it. During the day green material, such as silver-beet, rape, cabbage, chaffed green oats, &c., should be liberally provided, while crushed oyster-shell, gravel grit, and clean water should be always available to the birds.

It is well to remember, where laying pullets are concerned, that sudden changes in the system of feeding are often responsible for retarding production; any contemplated change should be made by degrees. For a bird to lay out of its natural season good and liberal feeding is imperative, but protection from climatic extremes, absolute cleanliness, and general common-sense management are of equal importance, and must therefore go hand-in-hand with a sound system of feeding.

ECONOMY ON THE PLANT.

The heavy cost of production facing the poultry-keeper by way of dear foodstuffs makes it imperative that economy in all things connected with the plant be seriously considered—that is to say, if payable returns are to be forthcoming. The most important point in this respect is to see that all hens of the drone type, or those which have passed their best period of usefulness, are got rid of at the earliest possible moment. This applies equally to all surplus cockerels that have attained a marketable age—from four and a half to five months old. The poultry-keeper cannot afford to retain any bird on the plant that is not paying its way nor is likely to do so in the near future. Notwithstanding the high cost of food, poultry are a good proposition provided that nothing but high-class laying-stock is kept and modern methods of management are adopted, among which economy is an essential detail for the best results. Assuming the possession of a flock of nothing but high-type layers, it is the worst form of economy to stint them in their food. It is now generally recognized that the heavy-laying bird cannot be overfed with the right class of food.

Half-starved fowls are never profitable, and are generally the first to contract disease. It is always a sounder policy to cull the drones than stint the profit-makers.

It is poor economy to expect birds to lay well when overcrowded. It is better for five hundred layers to be doing their best under favourable conditions than to have double the number doing indifferently, to say nothing of lessening the risk of the birds contracting disease which may end in disaster. Wherever possible fowls should be fed in the house and made comfortable, especially during unfavourable weather. In this way a dual form of economy is brought about. Firstly, because only a minimum amount of food will be required to maintain the bird, as heat to dry it and ward off the cold when it is fed in the rain must necessarily come from the food eaten. Secondly, there is a great saving effected by protecting the grain from sparrows and other small birds. It is safe to say that on many plants the money saved in this way in one year would more than compensate the cost of making houses of sufficient depth to confine the birds and feed them under cover.

It is sound economy to put a wire-netting partition down the middle of a run, and keep the birds off one half, in order to give the ground a chance to sweeten by being turned over and sown down. There is nothing more conducive to heavy laying and the prevention of disease than a fresh, clean run. The clean run is just as necessary as the clean house. It spells economy to spare no effort to keep the quarters in a thorough sanitary state, and to guard against the birds being attacked by insect pests. These parasites cause a constant drain on the fowl's vitality, and where they are numerous it cannot make the best use of its food.

It is attention to the details that makes poultry-keeping pay—not doing one thing well and neglecting others. It should always be realized that the profit in poultry-keeping is not so much determined by the gross return as by the difference between cost of production and the market value of the produce.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

REMOVAL OF SUPERS.

AMONG the autumn work which must not be neglected is removal of the supers, and this should be undertaken as soon as the extracting-combs are cleaned up by the bees. It is bad management to leave the bees more space than they can occupy. By removing the supers the space in the hive is restricted, and consequently it is much easier to make the bees snug and warm for winter. Where the strength of the colony will permit this to be done, nothing is to be gained by leaving on the supers. However, it may be impossible in the case of strong colonies to confine the bees to the brood-chambers, in which case the supers can be left on the hives until the spring. By that time most of the bees will be in one story, and the supers can then be removed.

A good plan to follow in getting the bees to clean up the combs is to insert a mat, in which a small hole has been cut, between the brood-chamber and the super. The bees, finding the combs partly cut off by the mat, lose little time in removing the surplus honey. At this operation the excluders should be removed from the hives, and stored away until such time as they can be cleansed of burr combs. A little care is necessary in dealing with the excluders, so as not to bend the wires. They can be readily cleansed by plunging them into boiling water.

WINTER STORES.

The losses attendant upon starvation are no less serious a menace to the beekeeper than disease. While disease is met with from time to time, each autumn brings the problem of wintering the bees, and, while the professional will prepare his colonies so as to guard against serious losses, the average beekeeper is apt to overlook the essentials that make for success. There are factors, such as shelter, water-tight hives, vigorous young queens, &c., which all play a part in the wintering problem; but, above all, a supply of food sufficient to meet the colonies' wants must not be overlooked. The safe wintering of bees is a test of a beekeeper's capabilities, as he is called upon to gauge the amount of stores required to tide his bees over the period between the autumn flow and the appearance of the early nectar-secreting plants. Locality plays an important part, more especially where autumn flows are unknown and fine autumn weather prevails. In these districts the consumption of stores is greater, and a constant watch must be kept on the hives so as to determine the amount of food required to guard against loss, as breeding will be carried on until a later period in the season.

Various estimates have been given as to the amount of food required to winter the cluster—varying from 30 lb. to 40 lb.—and experience has proved that, providing a colony is left with this amount, it will not only winter well but will build up rapidly in the spring. In any case, it is by far the safest policy to leave an excess of food rather than run the risk of leaving the colony short and with barely enough to tide it over the dormant period. Where the amount of stores is less than 30 lb. the shortage can be made up quickly by the insertion of a few combs of honey. Calculating on the basis that a full comb contains 6 lb. of honey, it is easy to estimate the weight of honey in the hive. If, however, combs of honey are not available, feeding should be undertaken. This latter operation should not be delayed till the cold weather, but commenced early in the autumn.

For supplementing the stores, sugar syrup, fed in the proportion of two of sugar to one of water, is the best substitute for honey. Avoid using inferior qualities of sugar. None but the best white sugar should be fed. In feeding to augment the winter food-supply it is often necessary to give large quantities of syrup, and consequently large feeders must be adopted. The Miller and the division-board feeders are excellent for the purpose. The former enables about 10 lb. to 25 lb. of stores to be fed at one time. It is designed to be placed inside the super or upper story on top of the brood-frames, and has two compartments for syrup, the passage-way for the bees being in the centre through the bottom, directly over

the cluster. The division-board feeder is popular, and enables about 5 pints of syrup to be fed. Hanging between the frames, all that is necessary is to turn back the mat so that the opening in the top is exposed. The main advantage of this feeder is that food can be supplied without exposing the cluster and without the aid of smoke.

SHELTER.

As in the spring, a vital necessity at this time of the year is shelter for the hives. Brood-rearing must be encouraged if the bees are to go into winter quarters sufficiently strong to give good results the following season. If a shelter-hedge or fence has not been provided an excellent temporary breakwind of manuka scrub can be erected. Shelter without too much shade is the life of an apiary, and on no account should large trees be utilized as a means for protecting the hives. The spaces between the trunks are productive of draughts, and the high branches exclude too much of the sunlight. A live hedge 8 ft. to 10 ft. high is the ideal shelter for an apiary.

FOUL-BROOD.

The risk attendant on carrying over diseased bees is too great, as the trouble is more likely to be spread in the autumn and spring by robbing. In cases where weather conditions have prevented successful treatment, or in which disease is detected on making a final examination prior to putting the bees into winter quarters, it is advisable to remove all combs showing the slightest signs of disease. Where disease is detected in a bad form nothing will be gained by holding the colony over for treatment, and by far the safer plan is to destroy it. In mild cases remove all the diseased combs and substitute clean drawn-out extracting-combs; provided plenty of capped stores are given, this will tide the colonies over until the spring. Mark all infected colonies as a reminder for early treatment. Avoid disturbing diseased hives in the off season, and guard against manipulations calculated to disturb the bees and induce robbing.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

Crops for early spring cutting should now be planted out without delay if this has not been already done. These crops consist chiefly of cabbage and lettuce, but cauliflower may be included in districts where the climate is sufficiently mild. In such districts it has a decided advantage over broccoli, which requires a very much longer growing-period, the first part of which is made difficult by the prevalence of cabbage-moth. On warm, well-drained land peas for early spring picking may be sown. Complete the earthing-up of celery. When asparagus foliage commences to turn colour cut it to the ground, remove it, and clean up the beds. The evergreen winter rhubarb may receive dressings of fertilizers now to induce a strong autumn growth. Land not required immediately for cropping will be greatly benefited by

being sown in a cover-crop to be turned in later. In many cases a dressing of lime applied before sowing would be a great advantage.

Hedges should be trimmed well back, and all necessary attention given to drainage. Heavy land of high value, such as is generally used for this class of cultivation, should receive careful attention in this respect. Open drains containing heavy summer growth, if allowed to continue in that condition, make the land cold and wet, and spring growth is therefore late in getting a start.

TOMATOES UNDER GLASS.

Growers of tomatoes under glass will commence operations for another season next month. As in most other undertakings, success largely depends on adequate preparations being made and the plants being given a good start. In these days of hydro-electric power some growers raise their plants in a propagating-house electrically heated, but many others will be using a hotbed. These are sometimes unsatisfactory. It should be remembered it takes two or three weeks to make a hotbed properly, and *fresh* stable manure is required for the purpose. The manure is conditioned by placing it in a compact heap. In three or four days, when it has heated up, it is shaken out and restacked, care being taken to moisten any portions that are dry. Repeat this operation when it has heated again, and after a similar interval it should be ready for use, and the hotbed can be made up. The object of this preparation is to secure an even state of fermentation throughout the mass, which can only be done by careful mixing and seeing that all parts are equally moist. Attempts to dispense with this preparation result in a fierce, uneven heat for a short period, after which the plants receive no benefit, but are subject to ordinary temperatures—a severe experience in the middle of winter, even though it may be under glass.

The compost heap for the seed-boxes will also possibly require attention. Unless it is already well mixed it would be as well to turn it over once or twice now, adding meanwhile any further ingredients that may be required.

TOBACCO.

Most of this season's tobacco crop will now be dried and ready for stripping. A great deal of damage is often done during this operation by handling the leaf before it is in the right condition. The result is badly broken leaves and a considerable loss of material. While the plant must be well dried out in the first place, it cannot be handled safely when in a brittle condition. One has to wait for humid weather, or create those conditions artifically, when the leaf will quickly become sufficiently pliable and tough to stand this operation without damage. Watch stocks carefully in order to avoid the development of moulds. The danger is greatest in wet weather.

SMALL FRUITS.

The planting-out of strawberry-plants should be completed as soon as possible, also the preparation of the land for other berry plants where an extension is decided upon. Cultivate deeply and subsoil the land; once it is planted there is no further opportunity of doing

so. Bush plants will be ready for lifting about the end of May. Select the plants carefully and place your order early.

SHELTER AND ORNAMENTAL PLANTATIONS.

During the short period from June to August inclusive trees and shrubs may be shifted in fine weather with safety, so that the time for action is now very close at hand for those who have this class of work to do. Not only does the land usually require thorough preparation, but the most careful consideration needs to be given to the scheme of planting, after which the plants should be selected and ordered without delay.

Many acres are wasted for years by hasty ill-considered planting which has afterwards to be removed. The taste and purpose of the planter and the climate and soil are the factors governing the situation. The two latter are frequently misjudged, and commonly full advantage is not taken of a soil and climate offering unique possibilities. Besides getting professional advice and keeping in touch with modern literature, the planter should carefully consider the condition and appearance of trees and shrubs growing in his locality on similar soil, and remember that outside of that experience he is entering on the experimental.

Among settlers in the back country it is common to speak of "white-pine land" or "birch country," &c., meaning that on the land in question in a primeval state such trees were outstandingly conspicuous. Further, experienced men know just the class of land that will be found associated with these types. This association is not confined to the larger timber-trees; it extends also to a large extent to the shrubs, climbers, and herbaceous plants and ferns. This habit of our indigenous vegetation is not peculiar, but applies also to the plants of other countries. The many exotics grown by nurserymen have to be studied from this point of view, and the planter working on these lines allies his efforts to a wonderful natural power that achieves its objects with maximum results. The planter is undoubtedly wise to keep his choice well within the list of plants adapted to the class of land and climate to be dealt with, whether the object be ornament or utility.

—*W. C. Hyde, Horticulturist.*

FORTHCOMING WINTER SHOWS.

Otago A. and P. Society: Dunedin, 2nd to 6th June.
Waikato Winter Show Association: Hamilton, 2nd to 6th June.
Manawatu A. and P. Association: Palmerston North, 16th to 20th June.
Wanganui A. and P. Association: Wanganui, 24th to 27th June.
Poverty Bay A. and P. Association: Gisborne, 25th to 27th June.
Wellington Winter Show Association: Wellington, 30th July to 15th August.
Auckland Winter Exhibition: Auckland, 27th July to 1st August.

Mole Drainage.—Where it is too expensive to tile-drain, and the subsoil is suitable, mole drainage will be found to have all the advantages of ordinary tiles with the exception of permanence, and is far less costly. Only land which is heavy in texture, free from stones, and with a good fall is satisfactory. Given these conditions the mole drains will usually last indefinitely.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

"DEPRAVED APPETITE" IN COWS.

T. Weatherall, Blue Spur :—

My cows are always chewing bones, and if any manure is spilt they will lick the ground where it has dropped. They have plenty of rock-salt, but will not touch it. Please inform me if there is anything I could give them, or is it the land that requires something?

The Live-stock Division :—

Depraved appetite or "pica" is a common complaint in certain localities, more especially on light land. It most often occurs in pregnant animals, and occasionally in young stock. The condition is recognized as the result of an insufficiency of lime or soluble salts in the soil. This being the case, it naturally follows that treatment of the soil—in this way removing the cause—is the logical procedure. Top-dressing with salt, lime, superphosphate, or basic slag gives good results. In dealing with the animals the diet should be as generous as possible. Crushed oats, bran, chaff, hay, or oaten sheaf should be fed. Once a day a handful of superphosphate should be given mixed in a feed of crushed oats, bran, and chaff; or, in lieu of the superphosphate, bonemeal, charcoal, and salt—a handful of each—may be given.

FUNGUS DISEASE ATTACKING WALNUTS.

"Inquirer," Morven :—

Could you give me advice as to what I could do to prevent a blight that has attacked the walnuts here? I am sending some specimens. Even where the kernel is fully developed it sometimes shows signs of the disease just beginning. Quite a number of the nuts are useless. The trees show small pockets on the leaves.

The Horticulture Division :—

The Biological Laboratory reports that these nuts are infected with the fungus *Aspergillus glaucus*, a species not uncommon on the walnut and numerous other nuts. Little can be done in the way of remedial treatment, save to ensure that the nuts are thoroughly dried out before being stored.

PRESERVING HOME-MADE BUTTER.

"Housewife," Hedgehope :—

Could you tell me a way of preserving home-made butter other than salting it down; or any way to keep it that it will not taste salty when used?

The Dairy Division :—

The only really effective way to ensure the minimum amount of deterioration in the quality of butter intended for keeping is to hold the butter in frozen storage. Actually, the addition of more than, say, about ½ oz. of salt to the pound of butter only increases the salty taste, and does nothing towards preserving the butter. To make butter for keeping it is advisable to scald the cream directly after separation, and to cool it down at once to a temperature of about 60° F., or lower if possible. Then churn it not less than about six hours or more than twenty-four hours afterwards, and while the cream is still sweet to the taste. Store the butter in well-closed containers and in as cold a place as possible.

HENS LAYING SOFT-SHELLED EGGS.

McDowell Bros., Mayfield :—

Kindly tell us the reason why hens continue laying soft-shelled eggs. We feed them every morning with bran and pollard mash with a small proportion of salt, and sometimes add a little burnt lime; evening feed, wheat or oats—mostly wheat. The hens get fresh water every morning and plenty of shell grit. They also have a good run-off on grass, clover, &c. They lay well, but soft-shelled eggs are the trouble.

The Chief Poultry Instructor :—

This disorder is generally the result of overfeeding forcing-foods, such as milk, meat, &c., or to the lack of lime as a shell-forming material, while in odd cases it may be due to some abnormal condition of the hen's reproductive organs. Seeing, however, that the ration provided is a plain one, and that ample sea-shell is available to the birds, it would appear that the usual causes of the trouble do not apply in your case. Evidently some local condition is responsible. In any case you are advised to discontinue adding burnt lime to the morning mash, as this may have an irritating effect on the ovary. Your best plan would be to leave the lime out in the weather till it becomes well broken down, after which the birds could be allowed to pick it when they desire. It may also be mentioned that as a shell-forming material fresh sea-shell is most desirable. Bleached shell, such as is often collected from the seashore, is not so good. There is nothing better than crushed burnt bone as a shell-forming material.

WINTER FARM-SCHOOLS, 1925.

The Department of Agriculture has arranged courses of instruction for farmers in the various districts as follows :—

Auckland.—(1.) At Dargaville, 18th to 23rd May; enrolment with Mr. A. R. Valder, Dairy Factory, Mangawhare. (2.) At Whangarei, 18th to 23rd May; enrolment with Mr. F. W. Webster, Secretary, Farmers' Union, Whangarei. (3.) At Ruakura Farm of Instruction, Hamilton, 25th to 30th May; enrolment with the Manager, Ruakura Farm.

Taranaki.—At Manaia, 15th to 20th June; enrolment with the Instructor in Agriculture, Moumahaki Experimental Farm, Waverley.

Hawke's Bay.—At Hastings, 1st to 6th June; enrolment with Instructor in Agriculture, Department of Agriculture, Hastings.

Wellington.—(1.) At Central Development Farm, Weraroa, 11th to 16th May; enrolment with the Farm-manager, or Instructor in Agriculture, Department of Agriculture, Palmerston North. (2.) At A. and P. Showgrounds, Solway, Masterton, 8th to 13th June; enrolment with Department of Agriculture, Palmerston North or Masterton, or Provincial Secretary, Farmers' Union, Masterton or Dannevirke.

Marlborough.—At Blenheim, 6th to 11th July; enrolment with Instructor in Agriculture, Department of Agriculture, Blenheim.

Canterbury.—Travelling school, 22nd June to 4th July; enrolment with Instructor in Agriculture, Department of Agriculture, Christchurch.

Westland.—Travelling school, 13th to 18th July; enrolment with the Fields Instructor, Department of Agriculture, Hokitika.

Details of the respective schools (programme, accommodation, &c.) will be published in the local Press in each case; any further information desired may be obtained from the individual enrolling officers. Early enrolment is advisable.

WEATHER RECORDS: MARCH, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

MARCH is the first month of autumn in New Zealand, and the weather this year was in striking contrast to that experienced in 1924. While last March was one of the wettest months ever experienced, especially in the east-coast districts, this year it has been one of the driest months of March on record. The weather was, on the whole, dry and sunny, warm by day and cool at night. Changeable weather with squally and showery conditions was experienced in the first fortnight, especially in the west-coast and southern districts. Anticyclonic conditions ruled from the 14th to the 25th, and during this time there was very little wind. The latter part of the month was somewhat unsettled, and there were sharp frosts about the 29th and 30th which cut down tender vegetation. There was also a light frost on the 16th in many parts, and fresh snow was visible on the mountains. These frosts were considered early for this season, and seven were recorded in Christchurch, ranging from one to five points.

Rainfall was above the average in the high country of the South Island and in Westland and Otago, and slightly so at New Plymouth; but everywhere else it appears to have been considerably below the average.

Records of bright sunshine for the month are interesting, the totals being as follows:—

Station.	Hours	mins.	Station.	Hours	mins.
Auckland	195	20	Wellington	206	17
Waihi	235	2	Nelson	248	50
New Plymouth	195	15	Blenheim	200	32
Moumahaki	170	30	Hanmer Springs	241	20
Weraroa (Levin)	192	0	Hokitika	195	8
Napier	213	30	Invercargill	149	45
Masterton	222	5			

—*D. C. Bates, Director.*

RAINFALL FOR MARCH, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	0·50	8	0·24	3·58
Russell	1·01	6	0·46	3·42
Whangarei	1·52	10	0·70	5·10
Auckland	1·30	8	0·47	3·06
Hamilton	2·53	13	1·32	3·74
Kawhia	2·70	9	0·72	3·12
New Plymouth	3·90	11	2·18	3·46
Riversdale, Inglewood	5·34	11	1·55	7·39
Whangamomona	2·68	5	1·42	5·46
Tairua, Thames	0·52	2	0·46	6·73
Tauranga	1·74	8	1·34	4·18
Maraehako Station, Opotiki	1·30	6	0·76	3·90
Gisborne	0·82	8	0·32	4·60
Taupo	0·70	5	0·43	3·53
Napier	0·53	5	0·28	3·40
Maraekakaho Station, Hastings	0·31	5	0·12	3·10
Taihape	1·82	8	0·54	2·69
Masterton	0·45	7	0·16	3·23
Patea	2·41	10	0·41	3·60
Wanganui	2·26	7	0·50	2·60
Foxton	1·44	5	0·50	2·36
Wellington	2·08	5	1·40	3·29

RAINFALL FOR MARCH, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	4·13	14	1·15	5·80
Greymouth	6·13	14	2·20	9·12
Hokitika	11·71	18	5·84	9·72
Arthur's Pass	19·21	11	7·58	5·84
Okuru, Westland	18·46	12	9·12	15·48
Collingwood	..	..	..	4·19
Nelson	2·16	6	1·88	2·99
Spring Creek, Blenheim	1·57	3	1·52	1·81
Tophouse	2·78	9	1·76	3·44
Hanmer Springs	1·43	6	0·72	2·84
Highfield, Waiau	0·66	2	0·48	3·09
Gore Bay	1·47	4	0·90	2·14
Christchurch	1·13	6	0·52	2·11
Timaru	0·56	8	0·38	2·45
Lambrook Station, Fairlie	1·16	3	0·86	2·58
Benmore Station, Omarama	4·32	10	3·28	2·64
Oamaru	0·99	7	0·72	1·77
Queenstown	3·63	11	1·61	2·63
Clyde	3·06	8	1·68	1·50
Dunedin	4·00	13	2·13	2·99
Gore	3·65	16	1·00	3·23
Invercargill	5·14	..	0·78	3·86

HONEY-EXPORT CONTROL.

THE following regulations under the Honey-export Control Act were gazetted on 26th March: (1.) The maximum fees payable to members of the Control Board shall be as follows—Chairman, £50 per annum; other members, £25 per annum. (2.) The maximum rate of travelling-allowance payable to members of the Board shall be £1 per diem, plus actual locomotion expenses. (3.) The charge payable by way of levy on all honey intended for export shall be one-sixteenth of a penny per pound. (4.) Any moneys payable under clause 3 hereof shall be paid to the Collector of Customs, on behalf of the Board, on or before the entry of the honey for export.

On the same date it was prescribed that notice by the Control Board of its intention to assume limited control of honey exported from New Zealand to the United Kingdom, the Irish Free State, and the Continent of Europe, to the extent of determining that all such honey shall be consigned to the Board's London agents, shall be given in accordance with the following conditions: (1.) Such notice shall be given either by service or publication as hereinafter provided not less than seven days before it becomes operative. (2.) Where notice is given by publication in a newspaper or newspapers, such publication shall be made in the *New Zealand Gazette* and in at least one newspaper published in each land district. (3.) Where a notice is to be served on either an owner of any honey or on any person having possession thereof, such notice shall be forwarded by "registered post."

MEAT-FREEZING WORKS IN NEW ZEALAND, 1924-25.

Name and Address of Company. *Land District.*	Name and/or Location of Works.	Beef-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity, in 60 lb. Carcases Mutton
North Auckland and Auckland.				
Auckland Farmers' Freezing Company, Ltd., Auckland	Moerewa ..	200	2,000	100,000
" " "	Southdown ..	200	3,000	202,000
" " "	Horotiu ..	200	3,000	218,000
Westfield Freezing Company, Ltd., Auckland.. ..	Westfield ..	250	3,000	205,000
R. and W. Hellaby, Ltd., Auckland	Westfield ..	120	500	3,000
East Coast Co-op. Freezing Company, Ltd., Whakatane	Whakatane ..	200	1,000	120,000
Hawke's Bay and Gisborne.				
North British and Hawke's Bay Freezing Company, Ltd., Napier	Westshore* ..	50	2,500	40,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch..	Pakipaki ..	30	1,800	70,000
Nelsons (N.Z.), Ltd., Tomoana	Tomoana ..	150	5,000	180,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings..	Whakatu ..	80	4,000	80,000
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa ..	Wairoa ..	100	3,000	165,000
Nelsons (N.Z.), Ltd., Gisborne	Waipaoa ..	150	3,500	270,000
Gisborne Sheep-farmers' Frozen Meat and Mercantile Company, Ltd., Gisborne	Kaiti ..	150	4,000	422,000
Ditto	Tokomaru Bay	60	3,000	140,000
"	Hicks Bay ..	75	1,500	60,000
Taranaki.				
Thomas Borthwick and Sons (Aus.), Ltd., Waitara ..	Waitara ..	200	2,000	80,000
New Zealand Bacon and Meat Packing Company, Ltd., Wellington	Eltham* ..	60	..	25,000
Patea Farmers' Co-op. Freezing Company, Ltd., Patea	Patea ..	150	2,000	180,000
Wellington.				
Wanganui Meat-freezing Company, Ltd., Wanganui ..	Castlecliff ..	100	2,200	100,000
New Zealand Refrigerating Company, Ltd., Christchurch	Imlay ..	200	6,000	271,000
Otaihape Farmers' Meat and Produce Co., Ltd., Taihape	Winiata* ..	50	1,200	90,000
Feilding Farmers' Freezing Company, Ltd., Feilding ..	Aorangi ..	100	4,000	153,500
National Mortgage and Agency Company of New Zealand, Ltd. (Head Office, Dunedin)	Longburn ..	60	2,000	100,000
Wairarapa Frozen Meat Company, Ltd., Masterton ..	Waingawa ..	120	5,000	150,000
Gear Meat Preserving and Freezing Company of New Zealand, Ltd., Wellington	Petone ..	100	10,000	300,000
New Zealand Bacon and Meat Packing Company, Ltd., Wellington	Ngahauranga ..	120	3,000	120,000
Wellington Meat Export Company, Ltd., Wellington ..	Ngahauranga ..	120	8,000	240,000
" " " ..	Kakariki* ..	100	2,000	90,000
Marlborough and Nelson.				
New Zealand Refrigerating Company, Ltd., Christchurch	Picton ..	30	2,000	30,000
Nelson Freezing Company, Ltd., Nelson	Stoke ..	30	500	50,000
Canterbury.				
Canterbury Frozen Meat and Dairy Produce Export Company, Ltd., Christchurch	Belfast ..	120	6,000	252,000
Ditto	Fairfield ..	..	4,000	100,000
"	Pareora ..	25	4,500	233,000
New Zealand Refrigerating Company, Ltd., Christchurch	Islington ..	50	7,000	375,000
" " "	Smithfield ..	50	6,000	304,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Kaiapoi ..	100	4,000	222,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch..	Belfast ..	..	5,000	120,000
Otago.				
Waitaki Farmers' Freezing Company, Ltd., Oamaru ..	Pukeuri ..	..	3,500	230,000
New Zealand Refrigerating Company, Ltd., Christchurch	Burnside ..	50	3,500	216,000
South Otago Freezing Company, Ltd., Balclutha ..	Finegand ..	50	2,500	200,000
Southland.				
Ocean Beach Freezing-works (J. G. Ward and Co., Ltd., Managing Agents), Invercargill	Ocean Beach ..	50	2,500	110,000
Southland Frozen Meat and Produce Export Company, Ltd., Invercargill	Mataura ..	50	2,500	104,000
Ditto	Makarewa ..	120	2,500	75,000
"	Bluff ..	..	..	114,000
Totals	..	4,220	144,200	6,889,500

* Not operating season 1924–25.

The New Zealand

Journal of Agriculture.

VOL. XXX.—No. 5.

WELLINGTON, 20TH MAY, 1925.

DAIRY-HERD TESTING FOR YIELD.

FACTORS INFLUENCING PRODUCTION.

W. M. SINGLETON, Director of the Dairy Division.

DAIRY-FARMING to-day is increasingly a scientific business, and as such requires the employment of careful and accurate methods. The present is a period for close application. When land, labour, and farming requisites were cheap, dairy-farming could be carried on without loss with far less skill than is the case to-day. Every factor is now of importance, and only those dairy-farmers who pay attention to detail and adopt scientific and businesslike practice can hope to succeed. The dairy industry has contributed very largely to New Zealand's fine standing as an agricultural country, and there is no larger scope for improving the industry than through the herd of the average dairy-factory supplier.

HERD-DEVELOPMENT.

Our dairy-farmers are continually confronted with the problem of herd-building. The dairyman acquires a farm and a herd, and plans by his labours to improve both and to work them to the maximum of efficiency. The personnel of the herd is ever changing, and even if a high average production is reached this has to be maintained. In building up the herd every step is important—culling, buying, breeding. Added to these is the general management of the herd. Success under each of these headings calls for experience and skill, and in each and every case the milk-scales and the butterfat tester form the crux of the

problem, the key to the situation. Whether the farmer buys or culls or breeds, the amount of butterfat which each cow produces is the indicator of the way. Yet, despite this, there are still many dairymen who are content to leave their herds untested and to work in the dark. Last year's statistics showed that New Zealand had 1,312,589 cows in milk and dry. For the same season about 151,000 cows were tested twice or more—this representing only 12 per cent. of the whole. Every dairy factory should have its herd-testing association, and every cow in every herd should be tested for at least a season.

WHAT INCREASED PRODUCTION MEANS.

There is no need to stress the fact that the testing of the dairy herd for butterfat-yield is the only way to arrive at that information which enables the owner to distinguish the cows which he is supporting from those cows which are supporting him. At the same time there are still many who do not fully recognize what the difference between a low-yielding and a higher-yielding cow may mean. It can be put very simply and clearly in this way: One cow may be worth—as a butterfat-producer — twice as much as another, or even more than two cows, although there may not be a very marked difference between the annual production of the two cows. For instance, let it be assumed that 160 lb. butterfat just pays for the year's care and feed, &c., of a cow. Then, a cow which produces 162 lb. butterfat is worth twice as much as a cow yielding 161 lb., because, obviously, she returns twice as much profit over care and feed. Similarly, a 260-lb.-butterfat cow makes twice as much above expenses as one which produces 210 lb.; or, she is equal to two cows each producing 210 lb.—that is, on the similar basis of 160 lb. butterfat returning exactly the cost of keeping and milking the cow. This means that a herd of, say, twenty cows with an average production of 260 lb. butterfat is as profitable as forty cows showing an average return of 210 lb.

Carrying the argument still further, one may compare two farms of equal carrying-capacity and carrying an equal number of dairy cows, and assume that number to be forty. If the forty cows on one farm yield 210 lb. butterfat each, and those on the other farm 50 lb. more, or 260 lb., then the higher-producing herd yields 4,000 lb. more butterfat in actual profit for a practically similar outlay in feed and care. With butterfat at 1s. 6d. per pound this means £300 per annum in money. Further, one cow producing only 100 lb. butterfat may nullify the profits on six cows each producing 170 lb. Summed up, it means that many dairy-farmers are keeping two or even three inferior cows where one better one would yield them as much profit, at one-half or one-third of the expenditure and labour. Dairy-farmers will therefore see that every pound of fat added to the average production means a considerable increase in their profits.

BASIS FOR CULLING.

The predominant principle in herd-testing is that the herd-owner may be supplied with more accurate data on which to form his judgment respecting the individual members of his herd from the viewpoint of production. The minimum production on which the

owner will determine his culling will necessarily depend on various factors, some of which may be stated as follows: (1.) Replacement: If he is keeping his herd up by purchasing he may adopt a more arbitrary standard, whereas if he is breeding heifers for replacement he has to consider the number of them available. (2.) The amount of feed available, which will largely depend on the character of his soil and quality of his pastures. (3.) On land higher in value than the average a higher production per cow is a general necessity.

IMPORTANCE OF THE HERD SIRE.

There are two safe methods of building a dairy herd: one is to buy in cows of suitable type and authenticated yield; the other is to begin with cows or heifers and a proven sire, or one backed by butterfat records, and to build gradually by culling out the low producers and breeding from the higher-yielding cows of suitable type. To continually buy in new stock requires more finance than many of our dairy-farmers can afford. Then again, few dairymen will sell their best cows unless they are past their prime, so that the purchaser is continually confronted with difficulties, and may sometimes find he is accumulating a herd of culls. The butterfat-record-sire method is perhaps a slower one, but is to be recommended. And, further, for quickest and most satisfactory results the sire should be a purebred.

The certificate-of-record system of testing purebred dairy cows provides for a 365-day milking-period. C.O.R. testing has now been conducted in New Zealand for some thirteen years, and it is advocated that for grade and crossbred herds the sire be selected from C.O.R. dams. If it is proved that for several generations certain females can give outstanding yields, then it is a reasonable assumption that by mating a bull from such dams with ordinary herd cows the resultant offspring should be an improvement on their dams. When selecting the sire the pedigree should be studied from the point of view of production of ancestors on both sides of the family, and productions of recent members should be given more importance than those of several generations back. The length of time that C.O.R. testing has now been in existence in New Zealand enables selectors to obtain full information in many cases for several generations of pedigree.

Next to production comes the question of type, and, although yield is of major importance, the selected sire should conform to accepted standards of true dairy type, and should possess the desirable characteristics of a herd sire.

There is a tendency among dairymen to use a sire for a season or two and then sell or destroy him. The true test of a sire is the quality of his daughters. If they are an improvement over their dams from the point of view of production, and do not retrogress in type, then it may be accepted that the sire is a success. Not until the daughters bear living testimony to the inefficiency of the sire should he be destroyed.

The advantage of a purebred over a crossbred sire is considerable. Experiment has proved that with a purebred bull a breeder is likely to achieve more in two generations than in five generations with a grade bull three-quarters pure.

INFLUENCE OF THE PUREBRED DAIRY SIRE.

As previously stated, the true test of a sire's worth is the quality of his daughters. It is difficult to get herd-testing-association figures on this phase of the subject, as our records do not include any information with respect to pedigree. From our records, however, have been collected sixteen instances where both daughter and dam have association records, the daughters having been sired by a purebred butterfat-record bull. Their sixteen daughters have improved on the average production of their dams by no less than 124·24 lb. butterfat. With two exceptions, each daughter has exceeded the production of her dam. These two daughters were two-year-olds; one produced only 3 lb. of butterfat less than her dam, and the other 21 lb. less. Doubtless, at ages equal to that of the dam these two daughters would show a higher yield. The sixteen dams were sired by eleven different bulls, so that the examples are fair, and the improvement cannot be attributed to the influence of one or two outstanding dams. Moreover, only two sires are represented, so that it may safely be assumed that the improvement has come from the male side.

Another example is the case of five different dams each from a different sire, and mated with a butterfat-record bull. These five dams, at an average age of 8 years 87 days at commencement of test, yielded an average of 441·36 lb. butterfat. Their five daughters, each from the butterfat-record bull, yielded, at an average of 1 year 347 days, 624·77 lb. butterfat, an average increase of 183·41 lb. The fact that the average production of the five dams was already very creditable, and that the average age of the daughters was low, makes this example an outstanding one. These figures are quoted from our C.O.R. returns to show what is possible if the right sire is chosen. What is more, the success of this particular sire was a more or less natural expectation, owing to the information which his butterfat-record backing supplied. He was line-bred to an outstanding bull of the breed, and, apart from this, the other animals figuring in the pedigree were for several generations back of proved outstanding merit.

LENGTH OF MILKING-PERIOD.

Statistics show that the average cow on association test in New Zealand milks about 230 days. It is safe to assume that the average lactation for all cows in the country is less. The writer has frequently expressed the opinion that the season of the average dairy cow in New Zealand is too short. Even on the basis of 230 days it means that there are more than four months in which our average dairy cow is doing nothing in butterfat-production. During that period she requires bodily maintenance, and general charges bearing on the cost of the cow's keep continue much as during the milking-period. Two months' rest from milk-production should be sufficient.

An endeavour should be made to obtain a type of dairy cow which will naturally milk a greater portion of the season than is the case at present. It may be possible by means of forced feeding and extreme care to extend the lactation of the average cow now in our dairy herds, but if the butterfat so added to the seasonal total does not compensate for the time and money expended, then the practice is

undesirable. The length of lactation should be governed by the efficiency of the cow as a butterfat-producer.

Progressive dairy-farmers recognize that a prolonged milking-period is the outcome of breeding and feeding for the longer lactation. Here again is driven home the importance of a herd sire chosen with regard to the results of the certificate-of-record testing, which provides for a 365-day production. If it is proved that for several generations certain females can maintain their production for a whole year, then it is a reasonable assumption that by mating a bull from such dams with ordinary herd cows the average term of profitable lactation will in time increase. Dairy-farmers should fully recognize that money spent in the purchase of a butterfat-record purebred sire is well invested.

DUAL VERSUS SPECIAL PURPOSE.

While no cow can do her best in producing milk and butterfat without an ample supply of succulent feed and without kindly treatment, the greatest consideration is the inherent tendency of the individual cow. In the earlier days of dairying in New Zealand the popular cow was what was called the dual-purpose cow, the two purposes being the production of both butterfat and beef from the same animal. In the minds of dairymen the dual-purpose cow was a sort of wonder animal which combined the best qualities of the two types. Experience, however, has proved that dual purpose is often another name for no purpose, and that by attempting to develop each, it happens more often than not that both beef and butterfat are sacrificed. There is perhaps no greater menace to our dairy industry than the dual- or no-purpose cow.

There are four types of cow—namely, (1) beef type, (2) dual purpose inclined toward beef, (3) dual purpose inclined toward dairy, and (4) special-purpose dairy type. Professor Haecker, at the University of Minnesota, conducted experiments with reference to the cost of production by these various types. Strict account was kept of the yield, and of all food consumed by each individual cow. Although the figures are old and may not apply to-day in actual values, it is evident that in proportion they will be as true as ever. The figures representing the feed cost per pound of butterfat were reported as follows: Beef type, 8·75d.; dual purpose inclined to beef, 7·55d.; dual purpose inclined to dairy, 7·30d.; dairy type, 6·05d. In every instance a cow of special-purpose dairy type produced a pound of butterfat at a lower feed cost than did any animal in the other three classes.

It is apparent that some animals use their food for the production of milk, others devote the larger proportion to the production of beef, while others—the dual purpose—may produce neither beef nor milk at a profit. It requires a certain amount of food to maintain the body of a cow, and the surplus she eats beyond this goes to milk or beef, or both. The general conformation of the cow is often an indication of what may be expected from her in the way of production.

There is an old argument that when a dual-purpose cow is done with she is worth a fair price to the butcher, whereas the finer-cut true dairy type will fetch very little. Fig. 1 shows a cow which on association test gave 3,268 lb. milk and 136·18 lb. butterfat. Fig 2.

shows another cow which also on association test produced 8,658 lb. milk and 404·77 lb. fat. The difference between these two yields is 268·59 lb., which, with butterfat at 1s. 6d. per pound, works out at a little over £20. And this was for one season only.

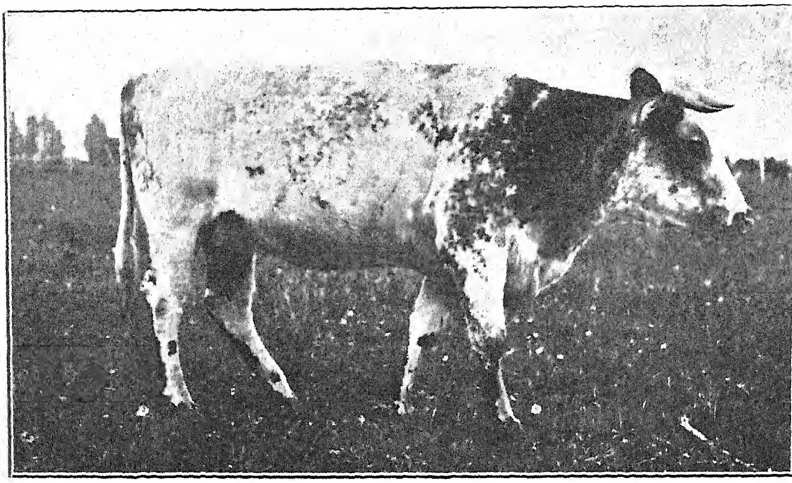


FIG. I. UNDESIRABLE TYPE OF COW FOR DAIRYING.

Season's yield only 3,268 lb. milk, containing 136 lb. butterfat.

FIG. 2. SPECIAL-PURPOSE DAIRY TYPE.

This crossbred cow milked 293 days, and gave 8,658 lb. milk, containing 404 lb. butterfat. Both animals shown were from ordinary mixed herds on association test. They were dry when photographed.

COMPARISON OF ASSOCIATION, C.O.R., AND FACTORY RETURNS.

The association system of testing, as is well known, supplies an index to the season production of a cow. Milk weights and samples are taken for two consecutive days in each thirty days, and the production for each thirty-day period is calculated on the basis of proportion. It is essential that the monthly weighing and sampling should be conducted at equal periods throughout the whole season, otherwise the butterfat-production according to the association records may not be as reliable as desirable. Careful weighing and sampling are also essential. Some dairy-farmers disparage the association testing because it does not agree with the factory returns. Before a fair comparison of the two is possible the returns should be for exactly the same period, and the total milk be from the same number of cows in each case. If proper and fair comparisons are made it will usually be found that the two will agree within satisfactory limits. Breeders of purebred dairy stock with the same cows under both C.O.R. and association test have a good opportunity of confirming the accuracy of the association system, and their opportunity of so doing is less fraught with difficulty. It has been found that, provided the weighing and sampling for the association returns are carefully and conscientiously carried out, results from the two methods will usually compare favourably. It may be accepted without discussion that the C.O.R. system gives results as accurately as may be expected, and is therefore a suitable basis for comparison.

In comparison of association and factory returns two examples may be selected from a number which have come under our notice. A herd of eighty-five cows in one association was credited with 12,909·5 lb. butterfat; the factory returns showed 12,760·7 lb. for a corresponding period. A herd of forty-two cows over a period of four months showed a variation of only 46·72 lb. butterfat between returns of association and factory, the association return being 5,468·66 lb. and that of the factory 5,421·94 lb.

There are, as previously suggested, certain factors which make it unreasonable to expect association and factory returns to exactly agree. These may be stated as follows: (1.) Milk fed to calves and milk for household purposes. (2.) Loss of butterfat in separation. (3.) Loss of butterfat in transit of cream. (4.) Inaccurate sampling. (5.) General conditions, such as weather, feeding, &c.; the association weights and samples may happen to be taken when the cows are producing normally, or when they are below normal, or when they are above normal; if the samples and weights are taken at an abnormal period the returns for the whole thirty days are affected. Speaking generally, although a comparison of returns, period by period, may not always give the agreement which might be desired, it is usually found that over the whole season the factory and association returns—taking into consideration these influencing factors—will compare satisfactorily.

In the following table are given the results for eighty-four cows which were tested under both association and C.O.R. system during the same lactation. In those cases where the cow was not on association test for the same period as she was under C.O.R. test the records

have been adjusted to the same number of days in milk, so as to make the comparison a fair one.

	Number of Cows.	Total Differences. lb.	Percentage Variation.
	30	459·21	4·2
	35	456·37	3·7
	19	194·32	2·4
All	84	1,109·90	..
Average		±13·21	3·6

Eighty-four cows will be accepted as representative, and, as will be seen, the average variation from the C.O.R. is only 3·6 per cent. This must be considered adequate proof of the accuracy of the association system.

EXAMPLES OF HERD-IMPROVEMENT.

The mass of herd-testing-association returns received by the Dairy Division from year to year supplies a large number of examples of improvement in average herd yield. The four cases quoted in the following table are more or less typical.

Member.	First Season.			Second Season.			Third Season.			Season Increases of Butterfat.		
	Number of Cows.	Average Days.	Average Fat.	Number of Cows.	Average Days.	Average Fat.	Number of Cows.	Average Days.	Average Fat.	Second over First.	Third over Second.	Third over First.
			lb.			lb.			lb.	lb.	lb.	lb.
A	44	270	256·72	40	280	314·84	41	281	334·25	58·12	19·41	77·53
B	39	206	213·51	42	278	303·99	41	272	319·30	90·48	15·31	105·79
C	47	226	271·30	47	230	314·30	50	276	335·58	43·00	21·28	64·28
D	47	197	198·00	46	220	248·37	44	230	287·96	50·37	39·59	89·96

As will be seen, the most marked improvements are for herds B and D. It will be noticed, however, that, to begin with, the average production in each of these cases was considerably below that of A and C. Obviously in herds A and C there was less room for improvement. When the average herd yield gets around the 300 lb. mark, improvement is slower and more difficult to maintain.

IMPROVEMENT IN ASSOCIATION AVERAGES.

Following are examples of improvement in production of average cow for associations as a whole. The figures cover the first four years' work of two associations.

Association A.

	Cows.	Days.	Butterfat. lb.
First year	430	236	219·93
Second year..	297	233	231·13
Third year	618	258	261·45
Fourth year..	620	264	286·60

Association B.

	Cows.	Days.	Butterfat. lb.
First year	265	187	177·58
Second year..	298	200	190·74
Third year	406	212	215·70
Fourth year..	266	214	232·37

Apart from the marked increase in average yield in each case will be noted the increase in length of average milking-period. High yield and long lactation, provided the cow herself is right, usually go hand-in-hand.

By way of deduction it may be pointed out that in Association A the increase is about 66·67 lb. butterfat. Had the 430 cows on test in the first year averaged the same as the 620 on test in the fourth year, it would have meant an increased total yield of 28,668 lb. butterfat, which, at 1s. 6d. per pound, means £2,150. On a similar basis the Association B results work out at about £1,085.

THE BUTTERFAT TEST.

Supplying a dairy factory often tends to emphasize in the minds of suppliers the *percentage* of butterfat in the milk supplied—commonly called the "test"—rather than the *quantity* of butterfat. Although the education which herd-testing has helped to develop has done much toward dispelling this tendency to think in terms of "test," one still finds many dairymen who are apt to overstress the importance of the butterfat percentage. Unless the herd is used for supplying milk for human consumption, when a certain legal minimum of fat has to be adhered to, the "test" itself can be taken too seriously. And, after all, even dairy factories do not pay out on test, but on test multiplied by weight of milk supplied—a very different matter. There is also a tendency, though less frequent, to stress milk-quantity; this is not as common in New Zealand as in those countries where records are taken for yield of milk alone.

A good example of the inaccuracy of judging milk-production by test alone or quantity of milk alone is found in a study of the records of purebred cows under C.O.R. test in New Zealand. Taking all Friesians (413) in the two-year-old class which have gained certificates since the commencement of the C.O.R. system in 1912 to the end of 1923, it is found that the six highest-testing individuals averaged 4·74 per cent., and the six lowest only 2·79 per cent. Judging from the test alone the first mentioned were 69 per cent. better cows than the lower testers. On milk alone the higher testers yielded on the average 9,601·4 lb., and the lower group 16,012 lb.; so that, judged on milk alone, the one group was approximately 67 per cent. better than the other. When one comes to butterfat, however, it is found that the average production for the groups was 455·19 lb. for the six higher testers and 447·26 lb. for the lower—an actual difference in production of only 7·93 lb., or, on a percentage basis, 1·8. Surely this speaks for itself.

All things considered, therefore, it is not right to judge a cow by milk alone or by test alone. The only fair and accurate guide to the ability of the dairy cow is her season butterfat-yield.

TEST VARIATION.

Another phase of the test problem which plays a prominent part in the minds of persons interested is that of the variation in the percentage of butterfat in milk. This matter has been fully dealt with by special articles in the *Journal*, but a few general remarks may not be inappropriate here. The examples quoted are gleaned

from data of C.O.R. testing, under which system the milk-samples are both taken and tested by the Dairy Division's fully qualified testing officers. The information is perhaps all the more valuable because purebred cows are, as a class, better cared for than the individuals of an average dairy herd.

We have known several instances of each of the following: (1.) Cows giving equal milk-weights for two consecutive days (with general conditions normal) and the same to show variations in test of 12 to 18 points. (2.) Cows decreasing by 10·9 lb. of milk and 24 points in test from one day to the next; 5·4 lb. milk and 12 points in test; and 2·5 lb. milk and 15 points in test. (3.) Cows increasing 3·8 lb. milk from one day to the next and increasing 11 points in test; 4·1 lb. milk and 8 points in test; 2 lb. milk and 22 points in test. (4.) During the menstruation period some cows have varied little, if any, in either milk or test; some have evidenced a decrease in milk-yield while the test has remained unaffected; some have shown a normal milk-yield and a decrease in test; and in some cases both milk-yield and test have been affected. (5.) It has also been proved that a change of milker may affect both milk-yield and test, usually to disadvantage. It pays to have cows milked by the same milker at each milking.

It therefore follows, as a general summing-up, that there is no definite rule governing a cow's test. Experience shows, however, that normal conditions, kindly and even treatment, and scrupulous care are well repaid. It is also obvious that when unaccountable test-variations occur such should not be immediately attributed to carelessness, malice, or lack of ability on the part of the person carrying out the testing of the samples.

FEEDING AND TREATMENT.

The dairy cow is a machine which will not give best results unless it is fed with the right quantity of the right material. It is possible to overfeed a cow with concentrates, in the same way as it is possible to overfeed a machine. The general tendency, however, is very much on the side of insufficient feeding. This may be the result of over-stocking or merely lack of attention to this phase of the subject. If a cow is of the right type it is usually found that the larger eater is the heavier producer. After maintaining her body, the more surplus feed she will convert into milk and butterfat the less is the proportionate cost of the butterfat.

It is better to permit twenty cows to yield 5,000 lb. of butterfat than to increase the herd to thirty cows and produce the same total, or more probably a reduced total, if the feed be only that quantity required by the twenty. Many of our dairymen are reducing their profits by endeavouring to run more cows than their land can profitably carry.

It is also a common practice to neglect dry cows, with the result that they freshen in poor condition. It pays to feed dry cows well. If they calve in poor condition they devote what should be their highest-yielding period to recovering the drain on the body occasioned by pregnancy and the act of calving and getting back into normal working condition. What is more, their whole season usually suffers, as often they do not pick up until their milk-flow is past its highest point for the season. On the other hand, if they come in a little

heavy in flesh the body is able to counteract the strain of freshening, and not only is the milk-yield and test improved, but the maximum milk-flow is maintained for a longer period and the length of the lactation increased.

Cows require even and kindly treatment. The ideal dairy-farmer does more than treat his cows sympathetically. Cruelty has been proved to affect both milk and test to the detriment of the factory return. Continued cruelty will shorten the lactation period—the owner is fined in pounds, shillings, and pence for every unkind act. The dairy cow is highly strung and sensitive, and these characteristics are more pronounced in the more refined and better-class animal. Speaking broadly, the cow gives what she receives. In return for proper feeding and kindly treatment she will give the best that is in her. Cruelty and lack of feed and care will kill those qualities which make her worth while as a dairy cow.

CONCLUSION.

Systematic herd-testing is a path which tends towards monetary success, but there is more in it than that. There is an educational value. The true dairy-farmer is a student and a breeder. The continual study of records and the increasing application and result of breeding-principle and experiment tend to broaden his intellect and make him methodical, painstaking, and quicker to recognize efficiency. It is gratifying to note from the steadily increasing number of herd-testing associations in this country that the great value of herd-testing, and all the term means, is making its importance realized.

The writer desires to cordially acknowledge the co-operation of Mr. H. G. Philpott, of the Dairy Division headquarters staff, in the preparation of the foregoing article.

Grading up of Sheep Flocks.—In the course of his recent report on the conditions and practice of sheep-farming in the Falkland Islands Mr. Hugh Munro, of the New Zealand Department of Agriculture, remarks: "When grading up from nondescript flocks it is a mistake to purchase high-priced rams to start with. In this country (Falkland Islands) I have seen rams which cost in England from £40 to £70 mated with very ordinary ewes of very mixed breeding, and I am informed that others costing up to £150 each have been imported and used in the same manner. Infinitely better value would be obtained by purchasing purebred flock rams at about £10 each (New Zealand price), for the reason that, when mated with this class of ewe, they will give equally good results and more can be imported for the money. There is no short-cut to the improvement of a nondescript flock. They must be graded up by each successive generation becoming better than the preceding one, by careful selection of the breeding-ewes, and the use of purebred rams of a higher standard of quality than the ewes."

Haystacking Precaution.—A farmer was killed recently in Taranaki during haymaking operations by the fall of the heavy centre pole of a stacker, through one of the guy-rope pegs pulling out of the ground. Evidence showed that the peg had been driven in about 1 ft. Although this followed the usual practice in the district, the occurrence indicates the necessity for great care in staying stacker poles, and that a greater depth than 1 ft. is requisite for pegs or stakes, according to conditions of soil, &c. The Coroner's jury recorded their opinion, in fact, that posts should be used instead of pegs.

LUCERNE VERSUS TEMPORARY PASTURE.

A COMPARISON AT MARTON.

J. M. SMITH, H.D.A., Assistant Instructor in Agriculture, Wanganui.

It is well recognized that where suitable conditions for lucerne exist there is no more valuable crop our farmers can grow, this having been proved many times. Unfortunately, however, it has been stated repeatedly that lucerne will grow on all types of soil and under practically any conditions; and while this may be literally true, the growing of lucerne on certain types of land has often turned out to be an unsound proposition, much to the farmer's regret. In considering lucerne, the point is not so much whether it will grow, but whether it will give returns in excess of any other crop in respect to quality, yield, and cost of production. The answer to the latter query is occasionally in the negative.

SOIL CONDITIONS AT MARTON.

The soil of the Marton Experimental Area, which is typical of much of the land in the district, is by no means a suitable one for lucerne. It is of a heavy clay type—so heavy and puggy, in fact, that mole drains (made by the drain-plough) have lasted for over fifteen years, and at the end of that period were still working satisfactorily in parts. The clay surface soil is underlaid in many situations by a stratum of hard ironstone which varies in depth from a few inches up to 18 in. or 2 ft., and lies anywhere between the surface and a depth of 4 ft. or 5 ft. This stratum could hardly be called a hardpan, however, as it is more or less broken, and is not continuous.

In connection with this ironstone it is interesting to note that during the summer months the roots of the lucerne go down beyond the stratum and draw their nourishment from below it; but with the rise of the dead-water level during the winter months the roots rot back to the ironstone, and it is not until the fall of the water in spring that the roots go down again. Thus it must be seen that much of the plant's strength is used up in the growing of new deep roots each spring, and this no doubt accounts to some extent for the slowness with which the crop comes away at that period. This is probably only a contributing factor, as the nature of the soil itself does not tend towards early growth.

Considering the soil-conditions at Marton it must be recognized that the lucerne has done remarkably well in yielding as it has, and its success is largely due to the fact that the stand has never been grazed. With constant or even occasional stocking the stand would probably have died out during the first season or two; it certainly could never have lasted as it has. It should be noted that, owing to the nature of the land, the crop has never been successfully cultivated. In early spring the land lies too wet for cultivating, the clay holding the moisture for a much longer period than a lighter soil would; then in autumn the land is too hard, and consequently cultivation cannot be carried out. This, of course, is only another point against the growing of lucerne on that type of soil.

LUCERNE AND TEMPORARY PASTURE: POINTS OF COMPARISON.

In making a comparison between a lucerne stand and a temporary pasture there are several points that must be kept in view. Firstly, there is the length of period of the usefulness of each of these crops. For instance, even on the class of land now referred to, the lucerne crop should continue to give fair returns for a considerable period after the temporary pasture has outlived its usefulness. Temporary pasture under many conditions, however, can be made to give splendid returns for five years or more by careful treatment, as will be shown. Secondly, it is important to bear in mind that hay crops from the lucerne stand represent the total usable product from that crop for the whole of the year, and especially so where grazing in the spring and late autumn cannot be carried out, or would be disastrous if attempted. On the other hand, the hay crops from the temporary pasture represent but part of the year's return. It may even be held that the hay crops are but four months' growth, while the remaining eight months represent a very considerable return through grazing. Thirdly, the cost of the year's operations in connection with each crop must be considered, and in this connection it will be seen that the annual cost per crop is about the same. Lucerne will require the same top-dressing, hence the manure bills will be equal. With regard to cost of harvesting, this should favour the temporary pasture, for with the latter there are at the most two hay crops a year to handle, whereas with lucerne there will be the cost of harvesting three or four crops.

RECORDS OF FIVE SEASONS.

The lucerne stand at the Marton Area was put down in December, 1918, when 15 lb. of Marlborough seed was sown to the acre. The land was limed with carbonate of lime at the rate of 1½ tons, and manured with basic super at the rate of 3 cwt. per acre. In the same year—November, 1918—a temporary pasture consisting of 25 lb. Italian rye-grass and 5 lb. cow-grass per acre was sown. It will be noticed that this is a purely temporary mixture. Basic super was applied with the seed at the rate of 2 cwt. per acre. It is between these two crops that a comparison will be made. In connection with the weights recorded hereafter for both crops, the figures given are tons and hundredweights of green material. Hay crops at the Area are carefully weighed when cut, so that these weights are accurate and representative.

During the 1919–20 season, unfortunately, no record was kept of the yield from the lucerne stand, but the temporary pasture was closed for hay on 1st October. It was cut on 19th December, and yielded 7 tons 14 cwt. per acre. The material was mostly rye-grass. On 16th February it was again cut, yielding 7 tons 15 cwt. of first-class cow-grass, giving a total return of 15 tons 9 cwt. per acre for the period 1st October to 16th February. This field (5 acres in all) carried 135 sheep all through September, and was ready for grazing again at the end of February. In addition to this the field carried between two and three sheep to the acre for the remainder of the year.

The following season, 1920–21, the lucerne was cut three times, yielding in all 17 tons to the acre. This same season the pasture field was closed for hay on 18th October, and was cut on 13th December, yielding 12 tons 17 cwt. per acre. The field remained closed until 17th March, when it was cut for a seed crop, this cut being practically pure clover. On threshing it yielded 148 lb. of clover-seed to the acre. During the month preceding the date of the first shutting-up for hay the 5 acres carried 101 sheep, and the area was again ready for grazing at the end of March. No actual record was kept of the grazing for the remainder of the year, but it is estimated that it carried between three and four sheep per acre.

The lucerne crop yielded four cuts during the 1921–22 season, the total yield on this occasion being 22 tons 6 cwt. per acre. The temporary-pasture field was closed early in October and cut for hay on 19th December. This crop yielded 14 tons 15 cwt. per acre. The pasture was cut for hay a second time on 13th February and yielded 6 tons 8 cwt., making a total yield for the year of 21 tons 3 cwt. In addition to this the area carried an average of 2·8 sheep for the whole year, or an average of 4·3 sheep for the period when it was not shut up for hay. It should be stated that in the early spring of this season the pasture was top-dressed with 10 cwt. of carbonate of lime and 2 cwt. of super per acre.

The 1922–23 season was not a favourable one for haymaking, and this put the lucerne at a greater disadvantage than the temporary pasture. Had the weather been favourable a fourth cut could have been made, but, as it was, only three were taken. The three cuts yielded a total of 17 tons 16 cwt. per acre. Only one cut of hay was taken from the temporary pasture during this season, on account of the weather conditions; it yielded 8 tons 3 cwt. per acre. In addition to this the pasture carried just over 2½ sheep per acre for the whole year.

Three crops were taken from the lucerne area during the 1923–24 season, the total yield being 14 tons 10 cwt. per acre. The temporary pasture was now in its fifth year, and yielded but one cut of grass, and that a fairly light one—5 tons 9 cwt. per acre. Notwithstanding the length of time that the pasture had been down, its carrying-capacity averaged 1·78 sheep per acre during this season, and it would have comfortably carried two sheep had they been available.

The results of the five seasons under review may be briefly summarized as follows, all yields given being green weights:—

Season.	Lucerne (sown December, 1918).	Temporary Pasture (sown November, 1918).
1919–20	No record	Two cuts, totalling 15 tons 9 cwt.; 135 sheep all September; 2½ sheep per acre for year.
1920–21	Three cuts, totalling 17 tons ..	One cut—12 tons 17 cwt.; seed-yield, 148 lb. per acre; 101 sheep all September; 3½ sheep per acre for year.
1921–22	Four cuts—22 tons 6 cwt. ..	Two cuts—21 tons 3 cwt.; 2·8 sheep for whole year.
1922–23	Three cuts—17 tons 16 cwt. ..	One cut—8 tons 3 cwt.; 2½ sheep per acre for whole year.
1923–24	Three cuts—14 tons 10 cwt. ..	One cut—5 tons 9 cwt.; 1·78 sheep per acre for whole year.

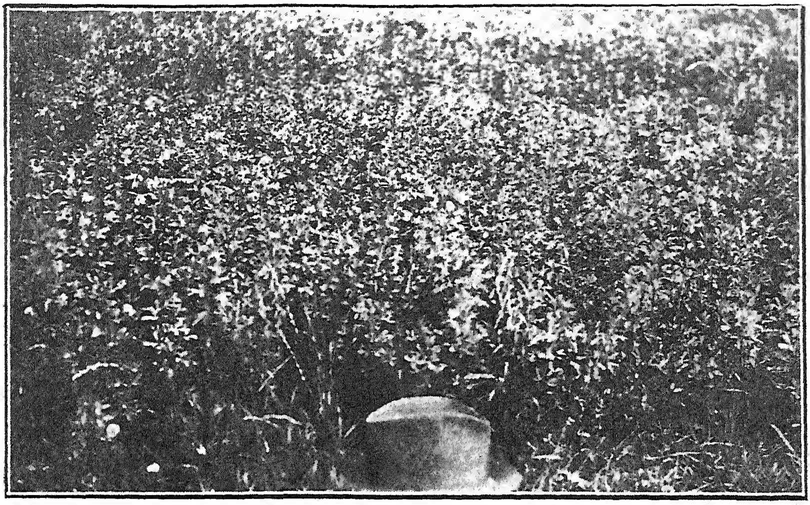


FIG. I. SHOWING A SECOND CROP OF LUCERNE AT MARTON EXPERIMENTAL AREA; CUT IN JANUARY.

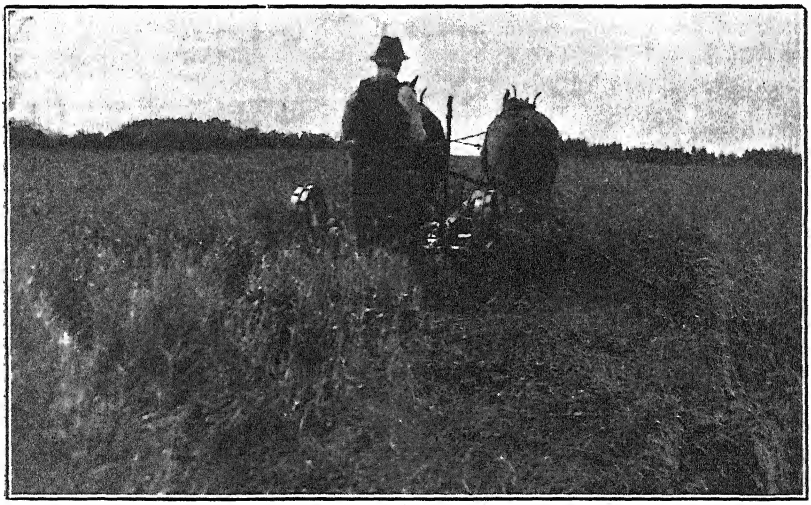


FIG. 2. MAKING A FIRST CUT OF THE TEMPORARY PASTURE AT MARTON IN DECEMBER.

As will be noticed, this crop consisted mainly of rye-grass.

From the foregoing records it will be seen that, taking all things into consideration, the returns from the temporary pasture are in excess of those from the lucerne. The actual hay-yields from the pasture (although it must be remembered this hay is not quite so high in quality as the lucerne hay) are very little below those of the lucerne, and then in addition the grazing of the pasture, which is very

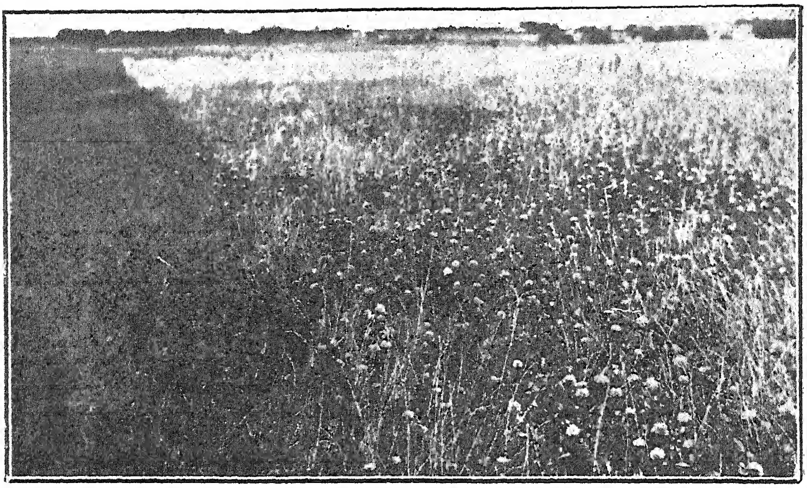


FIG. 3. A SECOND CROP OF THE TEMPORARY PASTURE; CUT IN JANUARY.

This was an even mixture of rye-grass and cow-grass.

FIG. 4. LAMBS ON AFTERMATH OF THE TEMPORARY PASTURE, FIVE WEEKS AFTER SECOND CUTTING.

The growth in this case was chiefly cow-grass.

considerable, must be taken into consideration. The quality of the grazing is shown in the increase in weight that lambs have made on the aftermath of clover after the second cut of hay. During February of this year twenty-four cull lambs were weighed and turned on to the clover. At the end of a fortnight they were again weighed and found to have put on an average of 4½ lb. per head.

A FURTHER COMPARISON.

In April, 1923, a further 13½ acres of temporary pasture were put down, the mixture being a little different from the previous one, having 10 lb. of perennial rye-grass included. This rye species, being more permanent, should give the pasture a longer life. During the past season this pasture was cut twice for hay, the first cut yielding 8 tons 18 cwt. of green material per acre, and the second cut yielding 7 tons 11 cwt., making a total of 17 tons 9 cwt. per acre for the season. The carrying-capacity of this area for the year ended June, 1924, was 2·78 sheep per acre. For the period between June and the shutting-up of the area for hay it carried just over three sheep. Although it is hardly fair to compare these results with that of the lucerne stand, which is now in its seventh year, it may be noted that the yield of the lucerne for the past season was 16 tons 15 cwt. of green material.

CONCLUSIONS.

The experience at Marton Experimental Area seems to indicate that temporary pasture of Italian rye-grass and cow-grass should there not be kept down longer than four years, as there is a considerable reduction in yield after that period; while in the case of the lucerne the yield in its sixth year was equal to the average of the previous five years. In any comparison between lucerne and temporary pasture at Marton the cost of renewal of the pasture has to be taken into consideration. As £4 per acre will be more than sufficient for renewal, allowing four years as the duration of the temporary pasture, it has to be weighted with £1 per year in excess of the lucerne. The high grazing-capacity of the temporary pasture would, however, in the case of soil similar to that of the Marton Area make any comparison distinctly in favour of temporary pasture.

WINTER DAIRYING AT HANMER SPRINGS.

THE Queen Mary Hospital farm at Hanmer Springs, North Canterbury, is operated primarily for the purpose of supplying milk to the hospital, and the supply must thus be kept up all through the year. The farm is situated 1,200 ft. above sea-level, and the locality is subject to heavy falls of snow in winter. The land is very poor, and owing to the comparatively short growing season the dairy herd has to be hand-fed for six months of the year, during which period the pastures are practically negligible. For four months of the winter the cattle are housed and all food is supplied in the bails. The food consists of oat-sheaf chaff, bran, oil-cake, mangolds (in season), hay, and rock salt. The cattle are given the following daily rations: Chaff, 14 lb.; bran, 2 lb.; oil-cake nuts, 2 lb.; mangolds, 40 lb.; and as much hay as they will consume. All this fodder is of the best quality, and the ration varies according to the time each cow has been in profit. Thus a cow six or seven months in milk will not be getting so large a ration as a cow at full profit.

During the winter of 1924 the herd consisted of fifteen to seventeen head, and ranged from cows fresh in profit to others seven and eight months in milk. During the six feeding-months, from April to September inclusive, eight cows were turned out dry and replaced with fresh ones, so the winter ended as it began with cows ranging from fresh in to others six and seven months in profit. The milk produced during the six months was 8,943 gallons, which averages close on 3 gallons per cow per day. The experience here recorded is claimed as a demonstration that winter dairying can be profitably conducted if carried out on right lines even under unfavourable natural conditions. The particulars were supplied by the farm-manager, Mr. W. B. Willis.

STINKING-SMUT OF WHEAT.

II. FIELD EXPERIMENTS ON CONTROL.

J. C. NEILL, Assistant Mycologist, Biological Laboratory, Wellington.

A PRELIMINARY article on stinking-smut of wheat appeared in the *Journal* for September, 1923. It contained a brief account of the available knowledge of the disease and the results of laboratory experiments with certain treatments in control. The present article records the results for 1924–25 of comparative trials in the field of sixteen of the most successful seed-treatments used in this and other countries for the control of this disease.

GENERAL PLAN OF EXPERIMENTS.

Four varieties of wheat were used in the experiments—Pearl, College Hunter's, Purple-straw Tuscan, and Solid-straw Tuscan. The last-named was harvested in January, 1924; the other three were one year older, being in fact the same parcels of wheat from which the samples used in the 1923 experiments, referred to above, were taken. All had been machine-threshed in the usual manner, and, for the purpose of these experiments, were inoculated in bulk with one part of smut-spores to 750 parts by weight of seed. The sample of smut consisted of *Tilletia Tritici* (Bjerk.) Wint. only, and had been collected by the writer at Winton in February, 1924. Samples of the four wheats were separately put through the various treatments in as identical a manner as possible—300 seeds from each sample being put to germinate* in the laboratory at approximately the same time as the remainder were being sown at the Ashburton Experimental Farm. The Pearl and the Hunter's were sown in the autumn, the Purple-straw and Solid-straw Tuscan in the spring. The ground used for the experiments had not carried wheat for at least seven years. The seed was sown in rows 5½ yards long, with 1 ft. between rows, each row taking 100 seeds spaced 2 in. apart. A piece of flexible wire rope, with permanent marks at each 2 in. and a spliced loop at one end, was used both to line out the drills and to locate the exact position for each seed—the latter being sown by hand. This method is quick and accurate, since, the seed being visible during the whole operation, mistakes are readily noticed. The exact position of each seed is also found at any subsequent time by slipping the loop over the permanent marker-peg and stretching the rope along the row. Thus in the subsequent counting operations each row may be divided into any desired number of subdivisions to facilitate statistical examination of the results. In the experiments recorded here the 25, 50, and 75 marks were given extra prominence, thus dividing each sown row of 100 seeds into four equal parts. Each treatment was given four rows, a total of 400 seeds, and the results recorded separately on each of the sixteen divisions thus made and calculated as percentages on twenty-five seeds. The Probable Error of each of the mean results tabulated was computed on these lines, but, since statistical examination

* All the laboratory germinations here recorded were carried out by the Seed Analyst, Mr. N. R. Foy, and his assistants, Messrs. Cooch and Traill.

using this factor does not materially alter the obvious comparative significance of the data there given, the writer has refrained from further complicating the already rather overloaded tables. The data, however, will be gladly supplied to any worker to whom they may be of interest. Between each four rows of treated seed two rows of untreated seed from the same original sample were sown and counted in the same manner. The tables are presented in the order of sowing.

DISCUSSION OF TREATMENTS.

COPPER CARBONATE.

Copper carbonate was brought into prominence as a control for stinking-smut by the publication in the *Agricultural Gazette of New South Wales*, in 1918, of the results of three years' experiments by Darnell-Smith and Ross. The favourable nature of these results has been in the main confirmed by subsequent workers, and to-day the copper-carbonate treatment is generally recommended by plant pathologists in Australia and in the United States of America for the control of stinking-smut. Copper carbonate is a simple chemical compound, insoluble in water, and is mixed with the seed in the form of dust. Several firms are now making copper carbonates specially adapted for seed-treatment, and three of these were used in the present experiments, viz.: No. 1—Corona Coppercarb, made by the Pittsburgh Plate Glass Company, Newark, New Jersey, U.S.A. This product contains about half the proportion of copper compared with the other two brands, and is used at a double strength—the makers claiming that this ensures better covering of the seed, and hence greater effectiveness as a fungicide. This material arrived too late for the autumn sowings, and so was used only with the two Tuscan wheats. The wholesale price, f.o.b. New York, is quoted at about 10d. per pound. No 2—Stauffer's Copper Carbonate, made by Wheeler, Reynolds, and Stauffer, San Francisco; New Zealand agent, G. J. Miller, Ferry Buildings, Auckland; wholesale price quoted at about 1s. 5d. per pound. No. 3—Copper-carbonate sample supplied by Bowden Bros. and Co., Ltd., Sydney, N.S.W.; wholesale price at Sydney, 1s. 3d. per pound; makers not known to writer.

Method of Treatment used in Experiments.—Smutted seed was shaken vigorously for two minutes in a closed container with copper-carbonate dust in amounts proportionate to 4 oz. to the bushel for No. 1 and No. 2A, and 2 oz. per bushel for No. 2 and No. 3. The treatment marked "Copper carbonate No. 2A" in the table is No. 2 (Stauffer's), used at the rate of 4 oz. per bushel of seed.

Summary of Experimental Results.—(*a*.) Effect on the smut: With the low to medium infections shown by the Pearl, Hunter's, and Purple-straw Tuscan, all three copper-carbonate treatments (with the exception of a single head in the Hunter's) completely controlled the smut. With the high infection shown by the Solid-straw Tuscan, control was not complete, though only about ½ per cent. of the heads were diseased, as against about 30 per cent. with the untreated seed.

(*b*.) Effect on the wheat-plant: In field germination, vigour of seedling, and number of heads harvested no significant differences were shown between the copper-carbonate-treated and the untreated seed—what difference there was being slightly in favour of the former.

Practical Considerations.—The copper-carbonate-dust treatment has several important advantages over the bluestone and formalin methods at present in use in New Zealand. It is simpler, safer, less laborious, and can be done at any convenient time prior to sowing, since the treated seed does not specially deteriorate on keeping. It controls stinking-smut just as efficiently, and effects a considerable saving of seed, since only the minimum quantity need be sown in the safe knowledge that the seed is undamaged. The main disadvantages are that a special machine is necessary to ensure proper mixing of the dust and seed, that copper-carbonate dust is very unpleasant in its effects when inhaled by the operator, and that compared with bluestone and formalin the cost of the material is high. For the first of these disadvantages several special machines are now being made suitable for treating large quantities of seed, and for smaller quantities all that is really necessary is a box or barrel fitted with a tight lid and mounted so as to be capable of fairly rapid rotation. An old barrel churn within which has been fixed one or two baffle-plates is quite suitable. For the second objection a dust-mask or a wet sponge or cloth over mouth and nose will largely avoid the trouble. The cost for material should be about 2½d. per bushel of seed. The treatment could probably be most efficiently and economically done in conjunction with the various seed-cleaning plants—the farmer receiving his seed cleaned and treated ready for sowing.

BLUESTONE (COPPER SULPHATE).

Bluestone has been in use since the eighteenth century as a seed-treatment for stinking-smut, and is still perhaps the treatment in most general use in New Zealand. The experimental results here given merely confirm the experience of many investigators and of most farmers—namely, that the bluestone steep, while fairly efficient as a controllant of stinking-smut, causes a marked loss in germination and in vigour of the seedling.

Method of Treatment used in Experiments.—Smutted seed was immersed for ten minutes in solutions made up of 1 lb. bluestone to 10 gallons water and 1 lb. to 5 gallons respectively, allowed to drain in a wet mass for twenty minutes, and then spread out to dry. In each case half the seed was dipped, after treatment and before drying, in limewash made up of 1 lb. quicklime to 10 gallons water.

Summary of Experimental Results.—(*a*.) Effect on the smut: With the low smut infection showing in the autumn-sown Pearl and Hunter's, all the bluestone treatments gave complete control of the smut. With the Purple-straw Tuscan, showing a medium infection, the 1-to-10-gallon treatment failed to give complete control, though the 1-to-5 was still effective. With the high infection in the Solid-straw Tuscan, none of the bluestone treatments were entirely effective, though all reduced infection to small proportions. Liming slightly reduced the effectiveness of both solutions in controlling the smut.

(*b*.) Effect on the wheat-plant: All the bluestone treatments showed a depressing effect on the germination, vigour of seedling, and number of heads harvested. This effect was more marked with the older seeds of the Pearl, Hunter's, and Purple-straw Tuscan. The stronger solution did more damage than the weaker, and liming reduced the damage in both cases.

Practical Considerations.—The advantage and disadvantages of bluestone can be discussed most effectively in conjunction with formalin, and will be dealt with under the latter heading. Whether the subsequent lime-bath is worth while must be left to the individual judgment on the figures presented, but there is a strong case in its favour where the 1-in-5 solution is used.

FORMALIN.

Formalin was first suggested as a smut-controllant in 1895. The excellent results given by it in laboratory trials and experimental work led to its rapid rise in favour among plant pathologists, who have of recent years generally given it preference over the older bluestone. On the farms, however, the formalin treatment is, in general, looked on with some suspicion, a suspicion which the experimental results recorded below will not tend to allay. However, a considerable portion of the cereals sown in New Zealand are regularly treated by this method. Commercial formalin consists of a solution of the gas formaldehyde in water, the sample used in the present experiments containing 39·2 per cent. formaldehyde (analysis carried out by the Dominion Analyst, Wellington).

Method of Treatment used in Experiments.—Smutted seed was immersed for ten minutes in solutions made up of 1 pint formalin to 40 gallons water (1–320) and 1 pint to 60 gallons (1–480) respectively, allowed to drain in a wet mass for twenty minutes, and then spread out to dry on blotting-paper on the laboratory benches. When outwardly dry it was placed in paper packets for conveyance to Ashburton for sowing. The "presoak method" consisted in soaking the seed in water at room-temperature for six hours, then steeping for ten minutes in 1–320 formalin solution, and draining for twenty minutes, followed by a rapid rinse in water before spreading out to dry as described.

Summary of Experimental Results.—(*a.*) Effect on the smut: With the low infection in the Pearl and Hunter's, all the formalin treatments showed complete control of the smut. With the medium infection in the Purple-straw Tuscan, both the straight 1–320 and 1–480 steeps were completely effective, though a single smutted plant appeared in the presoaked 1–320. With the high infection in the Solid-straw Tuscan, on the other hand, the presoaked 1–320 was the only formalin treatment completely controlling the smut, the ordinary steep at 1–320 showing 0·1 per cent. of smutted heads and the 1–480 showing 0·5 per cent., as against over 30 per cent. in the untreated controls.

(*b.*) Effect on the wheat-plant: The straight formalin steep at both the 1–320 and 1–480 strengths proved extremely detrimental to germination and vigour of seedling, and this applies to all four wheats, although the injury to the older Pearl, Hunter's, and Purple-straw Tuscan seed was much greater than to the newer Solid-straw Tuscan. In view of the fact that some workers have used these treatments without causing material damage to the wheat-plant, it appears that possibly some factor or factors may have been introduced in the present experiments which greatly accentuated the damage normally occurring with the formalin steep. The point requires further investigation. The 1–480 steep proved less harmful to the plant than the 1–320. The presoak method, however, with the Pearl, Hunter's, and Purple-straw

Tuscan produced a slight improvement in germination and vigour of seedling over the adjacent untreated controls; with the Solid-straw Tuscan these results were only slightly inferior.

Practical Considerations.—The formalin steep may be considered as an alternative seed-treatment to the older bluestone steep. Both control stinking-smut very well, so that other considerations must decide the choice of the user. The present experiments, for the reason already stated, should be accepted with caution as a guide in the case of formalin, except in so far as they indicate the tricky nature of treatment carried out with this substance and the possibility of getting, through some unforeseen circumstance, a disastrously low germination in the crop. The best results are given by the presoak-formalin method. This treatment, although it involves some extra trouble, should be perfectly feasible in farm practice—the extra trouble being well repaid in the certainty of obtaining a good and healthy stand. Where the straight formalin steep is used it appears that a strength of solution 1–480 can be advantageously substituted for the 1–320 strength employed. Both bluestone and formalin are cheap and readily procurable, the cost of treatment being rather in the time and labour employed than in the price of material. It seems likely that both will be supplanted in the near future by some of the newer materials and methods.

HOT WATER.

The modified Jensen method was used in the single experiment tried with hot water. The method is indispensable as a controllant of loose smut, and has been claimed as equally efficient in the case of stinking-smut. It has not yet had any extended application for this purpose.

Method of Treatment used in Experiments.—The smutted seed was immersed in water at 63° F. for six hours, dipped for ten minutes in water at 125° F., and spread out on blotting-paper to dry.

Summary of Experimental Results.—(*a.*) Effect on the smut: With the low infection present in the Pearl, the treatment gave complete control, and with the higher infections, though not completely eliminating the smut, it reduced its incidence to small proportions, showing 0·9 per cent. of infected heads, as against over 30 per cent. in the untreated controls in the Solid-straw Tuscan. It will be noticed that it also controlled the small percentage of loose smut present in the Purple-straw Tuscan.

(*b.*) Effect on the wheat-plant: The treatment had a very depressing effect on the germination and vigour of seedlings with the older Pearl, Hunter's, and Purple-straw Tuscan seeds. With the new seed of Solid-straw Tuscan this effect, though still present, was reduced to small proportions.

Practical Considerations.—This method has not yet reached the stage of practical application in New Zealand, but there are features connected with it, and especially in regard to the simultaneous control of both smuts, that may yet bring it to the forefront in importance.

CLARKE'S WHEAT PROTECTOR.

This is a proprietary fungicide manufactured in England. The New Zealand agents are Harris Bros., Christchurch. It is widely used

Table 1.—Pearl.

NOTE.—200 seeds were sown for each control, 400 seeds for each treatment.

Treatment.	Date.		Percentage Germination.					Plants.			Heads.			Percentage Difference compared with Adjacent Controls.	
				In Field.											
				First Count.											
	Treated.	Sown.	In Laboratory.	Percentage.	P.E. ±	Mean Height.	Final Count (Mature Plants).	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	Total Heads.	Sound Heads.
	May, 1924.				*	In.									
Control	..	28	95·5	61·6	3·21	1·60	57·0	114	2	1·8	820	2	0·2	..	..
Copper carbonate No. 2A ..	26	28	96·0	79·2	2·00	1·72	71·7	287	0	0	2,126	0	0	+ 12·9	+ 13·2
Control	..	28	95·5	81·0	1·44	1·88	72·0	144	3	2·1	1,062	4	0·4	..	..
Copper carbonate No. 2 ..	26	28	96·0	79·0	1·84	1·81	69·5	278	0	0	2,118	0	0	+ 2·6	+ 2·9
Control	..	29	95·5	81·0	1·56	2·18	76·5	153	1	0·7	1,001	3	0·3	..	..
Copper carbonate No. 3 ..	26	29	96·5	83·2	1·28	2·01	78·7	315	0	0	1,883	0	0	− 3·7	− 3·5
Control	..	29	95·5	83·5	1·57	2·17	74·0	148	2	1·4	955	5	0·5	..	..
Bluestone, 1 lb. in 10 gals. ..	27	29	91·5	75·0	2·04	1·66	68·0	272	0	0	1,682	0	0	− 11·8	− 11·6
Control	..	29	95·5	85·5	1·44	2·27	78·0	156	3	2·0	954	8	0·8	..	..
Bluestone, 1 in 10, limed ..	27	29	94·5	82·5	1·32	1·86	78·2	313	0	0	1,698	0	0	− 8·0	− 7·4
Control	..	29	95·5	83·0	1·34	2·22	80·5	161	1	0·6	892	5	0·5	..	..
Bluestone, 1 lb. in 5 gals. ..	27	29	79·5	49·7	1·56	1·50	54·5	218	0	0	1,073	0	0	− 40·1	− 39·7
Control	..	29	95·5	87·0	1·08	2·35	77·0	154	2	1·3	901	5	0·5	..	..
Bluestone, 1 in 5, limed ..	27	29	95·5	70·0	1·00	1·75	71·0	284	0	0	1,484	0	0	− 12·9	− 12·5
Control	..	29	95·5	85·0	1·32	2·26	80·5	161	1	0·6	804	3	0·3	..	..
Uspulun	27	29	98·0	92·2	1·40	2·27	88·2	353	0	0	1,583	0	0	+ 3·9	+ 4·5
Control	..	29	95·5	85·0	1·45	2·28	76·0	152	0	0	719	0	0	..	..
Germisan	27	29	96·0	85·5	1·36	2·24	81·7	327	0	0	1,532	0	0	+ 2·2	+ 2·4
Control	..	29	95·5	82·5	1·80	2·25	79·5	159	0	0	779	0	0	..	..
Semesan steep	27	29	97·0	78·2	1·28	2·07	78·5	314	0	0	1,482	0	0	− 4·5	− 4·4
Control	..	29	95·5	82·0	1·83	2·10	77·5	155	2	1·3	774	4	0·5	..	..
Hot water	26	29	94·5	43·2	2·44	1·83	46·7	187	0	0	1,081	0	0	− 28·7	− 28·3
Control	..	29	95·5	80·5	1·83	2·07	71·5	143	1	0·7	744	3	0·4	..	..
Formalin, 1 pt. in 40 gals. ..	27	29	93·0	37·2	1·40	1·78	37·2	149	0	0	877	0	0	− 40·7	− 40·2
Control	..	29	95·5	81·5	1·84	2·09	71·5	143	3	2·1	735	8	1·1	..	..
Formalin, 1 pt. in 60 gals. ..	27	29	96·0	42·5	2·04	1·88	42·2	169	0	0	968	0	0	− 34·1	− 33·1
Control	..	29	95·5	84·5	1·44	2·06	80·0	160	6	3·7	735	11	1·5	..	..
Formalin, 1 in 40, presoak ..	27	29	97·5	81·5	1·10	2·16	77·7	311	0	0	1,417	0	0	− 3·3	− 1·9
Control	..	29	95·5	78·5	1·97	2·07	78·5	157	4	2·5	731	10	1·3	..	..
Clarke's Wheat Protector ..	27	29	68·5	48·5	1·45	1·79	44·5	178	0	0	977	0	0	− 31·4	− 30·1
Control	..	29	95·5	76·5	2·08	2·10	73·0	146	6	4·1	694	18	2·6	..	..
Semesan dust	26	29	97·5	84·5	1·16	2·14	81·0	324	0	0	1,392	0	0	+ 4·5	+ 8·7
Control	..	29	95·5	80·0		2·11	76·5	153	12	7·8	638	32	5·0	..	..

Table 2.—Hunter's.

Treatment.	Treated.	Sown.	In Laboratory.	Percentage.	P.E. ±	Mean Height.	Final Count (Mature Plants).	Plants Total.	Smutted.	Percentage smutted.	Heads Total.	Smutted.	Percentage smutted.	Total Heads.	Sound Heads.
Control	..	30	95·2	73·0	2·04	2·18	67·5	135	7	5·2	701	21	3·0	..	..
Copper carbonate No. 2A ..	26	30	92·5	69·7	1·76	2·13	69·0	276	1	0·4	1,429	1	0·1	+ 0·5	+ 3·1
Control	..	30	95·2	67·5	2·08	1·69	64·5	129	5	39	720	13	1·8	..	..
Copper carbonate No. 2 ..	26	30	96·0	68·2	1·44	1·86	70·0	280	0	0	1,456	0	0	− 2·0	+ 1·1
Control	..	30	95·2	70·5	1·80	1·95	68·5	137	8	5·8	766	30	3·9	..	..
Copper carbonate No. 3 ..	26	30	92·0	63·2	1·92	1·90	64·0	256	0	0	1,363	0	0	− 8·1	5·3
Control	..	30	95·2	62·5	2·03	1·86	63·5	127	4	3·1	718	13	1·8	..	..
Bluestone, 1 lb. in 10 gals. ..	27	30	83·5	51·7	1·48	1·68	57·7	231	0	0	1,235	0	0	− 16·0	− 14·6
Control	..	30	95·2	66·5	2·08	1·85	65·5	131	3	2·3	753	9	1·2	..	..
Bluestone, 1 in 10, limed ..	27	30	87·0	59·2	1·52	1·71	62·5	250	0	0	1,326	0	0	− 9·6	− 8·8
Control	..	30	95·2	61·5	1·81	1·78	62·0	124	2	1·6	714	6	0·8	..	..
Bluestone, 1 lb. in 5 gals. ..	27	30	56·5	38·2	1·44	1·43	43·7	175	0	0	1,204	0	0	− 13·5	− 11·7
Control	..	30	95·2	60·0	1·82	1·77	59·5	119	7	5·9	679	20	2·9	..	..
Bluestone, 1 in 5, limed ..	27	30	87·0	50·7	1·68	1·79	55·0	220	0	0	1,289	0	0	− 10·7	− 7·4
Control	..	30	95·2	72·0	1·64	2·22	70·0	140	9	6·4	765	31	4·0	..	..
Uspulun	27	30	91·5	77·7	1·32	2·13	75·0	300	0	0	1,435	0	0	+ 2·2	+ 10·1
Control	..	30	95·2	67·5	1·65	2·07	59·0	118	16	13·5	639	68	10·6	..	..
Germisan	27	30	95·0	71·2	1·72	2·16	68·0	272	0	0	1,407	0	0	+ 7·4	+ 20·6
Control	..	30	95·2	64·0	1·65	2·01	62·5	125	25	20·0	671	72	10·7	..	..
Semesan steep	27	30	95·0	64·8	1·32	1·93	65·0	260	0	0	1,335	0	0	− 0·2	+ 12·4
Control	..	30	95·2	62·5	1·82	1·98	61·0	122	20	16·4	667	74	11·1	..	..
Hot water	26	30	85·0	23·2	1·32	1·79	31·0	124	2	1·6	798	8	1·0	− 44·0	− 40·1
Control	..	30	95·2	66·5	2·00	2·07	67·0	134	11	8·2	760	36	4·7	..	..
Formalin, 1 pt. in 40 gals. ..	27	30	84·0	8·2	0·68	1·81	7·5	30	0	0	323	0	0	− 79·4	− 78·2
Control	..	30	95·2	70·5	1·84	2·03	66·5	133	9	6·7	814	48	5·9	..	..
Formalin, 1 pt. in 60 gals. ..	27	30	93·0	20·8	1·24	1·91	23·7	95	0	0	788	0	0	− 49·2	− 44·2
Control	..	30	95·2	62·0	1·80	2·03	62·5	125	18	14·4	737	88	12·0	..	..
Formalin, 1 in 40, presoak ..	27	30	95·0	62·8	2·32	2·09	63·0	252	0	0	1,429	0	0	− 1·6	+ 10·5
Control	..	30	95·2	62·0	1·90	2·10	59·5	119	17	14·3	716	69	9·6	..	..
Clarke's Wheat Protector ..	27	30	64·0	30·5	1·44	1·88	36·7	147	0	0	1,040	0	0	− 29·8	− 24·8
Control	..	30	95·2	62·[illegible]	2·06	2·01	61·5	123	6	4·8	767	26	3·4	..	..
Semesan dust	26	30	91·5	70·5	2·12	2·06	72·0	288	0	0	1,528	0	0	+ 8·8	+ 13·0
Control	..	30	95·2	61·5	..	2·07	60·5	121	6	4·9	636	22	3·4	..	..

* The Probable Error of each control is computed in combination with the next succeeding control.

Table 3.—Purple-straw Tuscan.

Treatment.	Date. Treated. (Aug., 1924)	Date. Sown. (Aug., 1924)	Percentage Germination. In Laboratory.	Percentage Germination. In Field. First Count. Percentage.	In Field. First Count. PE. ±	In Field. First Count. Mean Height.	In Field. Final Count (Mature Plants).	Plants. Total.	Plants. Smutted.	Plants. Percentage smutted.	Heads. Total.	Heads. Smutted.	Heads. Percentage smutted.	Percentage Difference compared with Adjacent Controls. Total Heads.	Percentage Difference compared with Adjacent Controls. Sound Heads.	Plants showing Loose Smut.
						In.				*						
Control ..	..	7	89·2	54·5	1·70	3·61	50·5	161	10	10·0	608	51	8·4	..	..	1
Copper carbonate No. 1 ..	2	7	90·0	61·2	2·08	3·52	57·5	230	0	0	1,424	0	0	+ 8·8	+ 16·7	2
Control ..	..	7	89·2	57·5	1·18	3·57	53·5	107	5	4·6	700	34	4·9	..	..	0
Copper carbonate No. 2 ..	2	7	87·0	59·7	1·12	3·60	57·0	228	0	0	1,319	0	0	− 0·8	+ 9·6	2
Control ..	..	7	89·2	53·0	1·73	3·39	46·5	93	15	16·3	630	91	14·4	..	..	1
Copper carbonate No. 3 ..	2	7	84·0	58·8	1·52	3·26	49·5	198	0	0	1,261	0	0	+ 0·4	+ 11·7	3
Control ..	..	7	89·2	48·0	2·00	3·30	47·5	95	8	8·5	626	33	5·3	..	..	1
Bluestone, 1 lb. in 10 gals.	4	7	85·0	50·8	2·60	2·79	48·5	194	2	1·0	1,266	11	0·8	− 4·8	− 0·6	4
Control ..	..	7	89·2	60·5	1·79	3·16	55·0	110	6	5·6	704	31	4·4	..	..	3
Bluestone, 1 in 10, limed	4	7	86·5	52·2	1·96	2·97	52·2	209	2	1·0	1,319	15	1·1	− 8·5	− 4·8	4
Control ..	..	7	89·2	64·0	1·79	3·05	61·0	122	10	8·3	738	41	5·5	..	..	2
Bluestone, 1 lb. in 5 gals.	4	7	73·5	45·8	1·48	2·91	46·0	184	0	0	1,182	0	0	− 16·7	− 10·8	4
Control ..	..	7	89·2	53·5	1·66	3·36	53·0	106	11	10·4	682	54	7·9	..	..	1
Bluestone, 1 in 5, limed ..	4	7	77·5	52·2	1·32	3·13	52·7	211	0	0	1,326	0	0	− 2·1	+ 3·7	2
Control ..	..	7	89·2	49·0	2·26	3·23	51·0	102	4	4·2	672	21	3·1	..	..	6
Uspulun	4	7	82·0	72·8	1·84	3·46	68·5	274	0	0	1,478	0	0	+ 14·0	+ 18·6	3
Control ..	..	7	89·2	62·0	2·28	2·98	56·5	113	7	6·3	625	30	4·8	..	..	2
Germisan	4	7	86·0	64·2	2·28	3·45	61·7	247	0	0	1,512	0	0	+ 15·9	+ 23·1	4
Control ..	..	7	89·2	54·5	2·23	3·24	53·5	107	13	12·2	679	45	6·6	..	..	1
Semesan steep ..	4	7	87·0	64·5	1·92	2·97	61·5	246	0	0	1,438	0	0	+ 3·6	+ 8·5	3
Control ..	..	7	89·2	54·0	1·82	3·12	49·0	98	3	3·1	709	17	2·4	..	..	2
Hot water	1	7	82·0	35·2	1·72	2·88	34·7	139	3	2·1	1,155	13	1·1	− 23·0	− 19·2	0
Control ..	..	7	89·2	54·5	1·69	3·20	53·0	106	13	12·3	791	70	8·6	..	..	1
Formalin, 1 pt. in 40 gals.	4	5	81·0	18·0	1·68	2·53	18·7	75	0	0	776	0	0	− 54·6	− 45·8	0
Control ..	..	5	89·2	53·0	1·83	3·27	51·5	103	14	13·7	808	93	11·5	..	..	1
Formalin, 1 pt. in 60 gals.	4	5	81·5	29·0	1·84	2·80	28·2	114	0	0	1,062	0	0	− 28·3	− 21·3	1
Control ..	..	5	89·2	45·0	1·79	3·00	43·5	87	7	8·0	674	37	5·5	..	..	0
Formalin, 1 in 40, presoak	4	5	87·0	55·5	2·12	3·12	51·5	206	1	0·5	1,444	19	1·3	+ 9·4	+ 18·2	2
Control ..	..	5	89·2	46·5	1·75	3·11	45·0	90	16	18·0	646	77	11·9	..	..	1
Clarke's Wheat Protector	4	5	80·5	56·2	1·56	3·21	57·5	230	0	0	1,443	0	0	+ 3·7	+ 17·6	3
Control ..	..	5	89·2	57·0	1·82	3·16	54·0	108	14	13·2	745	84	11·2	..	..	2
Semesan dust	2	5	89·5	71·0	2·04	3·35	69·0	276	0	0	1,618	0	0	+ 15·1	+ 27·0	2
Control ..	..	5	89·2	61·0	..	3·35	58·0	116	13	11·6	661	48	7·2	..	..	4

Table 4.—Solid-straw Tuscan.

Treatment.	Treated.	Sown.	In Laboratory.	Percentage.	PE. ±	Mean Height.	Final Count (Mature Plants).	Plants Total.	Plants Smutted.	Plants Percentage smutted.	Heads Total.	Heads Smutted.	Heads Percentage smutted.	Total Heads.	Sound Heads.	Plants showing Loose Smut.
Control ..	..	7	98·8	94·5	1·04	4·28	91·5	183	80	43·7	861	270	31·3	..	..	..
Copper carbonate No. 1 ..	2	7	98·7	92·2	0·88	4·11	91·5	366	4	1·1	1,708	9	0·5	− 0·1	+ 46·0	..
Control ..	..	7	98·8	93·5	0·94	3·96	87·5	175	85	48·5	849	272	32·0	..	..	..
Copper carbonate No. 2 ..	2	7	99·7	92·0	0·96	3·94	89·0	356	1	0·3	1,683	3	0·2	− 1·8	+ 39·1	..
Control ..	..	7	98·8	94·5	0·92	4·02	92·0	184	80	43·5	866	233	26·9	..	..	..
Copper carbonate No. 3 ..	2	7	98·3	93·0	0·60	4·01	88·2	353	3	0·8	1,735	12	0·6	+ 1·7	+ 41·3	..
Control ..	..	7	98·8	94·5	0·92	3·88	90·0	180	84	46·6	840	251	29·9	..	..	..
Bluestone, 1 lb. in 10 gals.	4	7	97·3	88·7	1·20	3·93	85·0	340	4	1·2	1,692	10	0·5	− 1·3	+ 47·4	..
Control ..	..	7	98·8	92·5	1·22	4·30	91·0	182	99	54·4	875	321	36·6	..	..	..
Bluestone, 1 in 10, limed	4	7	99·0	90·2	0·96	4·27	88·0	352	6	1·7	1,704	17	1·0	− 0·4	+ 56·3	..
Control ..	..	7	98·8	91·2	1·17	4·08	89·0	178	99	55·6	836	308	36·8	..	..	..
Bluestone, 1 lb. in 5 gals.	4	7	94·0	88·0	0·92	3·95	85·5	342	3	0·8	1,592	6	0·3	− 5·4	+ 54·1	..
Control ..	..	7	98·8	91·0	0·82	4·17	86·5	173	96	55·5	847	347	40·9	..	..	..
Bluestone, 1 in 5, limed ..	4	7	98·7	88·0	1·28	4·02	82·0	328	3	0·9	1·614	9	0·5	− 4·5	+ 50·7	..
Control ..	..	7	98·8	95·5	0·62	4·27	93·5	187	82	43·9	843	288	34·1	..	..	..
Uspulun	4	7	98·7	97·7	0·60	4·38	92·2	369	0	0	1,640	0	0	− 0·4	+ 53·0	..
Control ..	..	7	98·8	96·0	0·71	4·09	91·0	182	92	50·5	804	294	36·5	..	..	..
Germisan	4	7	98·0	95·0	0·84	4·14	91·7	367	0	0	1,684	0	0	+ 2·8	+ 61·9	..
Control ..	..	7	98·8	97·0	0·97	4·16	94·0	188	94	50·0	834	301	36·1	..	..	..
Semesan steep	4	7	98·3	94·7	0·93	4·19	91·7	367	0	0	1,711	0	0	+ 4·3	+ 69·8	..
Control ..	..	7	98·8	92·5	1·06	4·03	88·0	176	96	54·5	806	327	40·5	..	..	..
Hot water	1	7	98·6	87·7	1·60	3·90	85·2	341	8	2·3	1,611	15	0·9	− 2·5	+ 41·4	..
Control ..	..	7	98·8	88·5	0·95	3·96	86·5	173	55	31·8	847	195	23·0	..	..	..
Formalin, 1 pt. in 40 gals.	4	5	98·0	67·5	2·08	3·24	63·2	253	1	0·4	1,456	2	0·1	− 13·3	+ 18·9	..
Control ..	..	5	98·8	90·0	0·71	3·76	85·5	171	78	45·6	833	261	31·3	..	..	..
Formalin, 1 pt. in 60 gals.	4	5	98·7	77·0	1·24	3·48	73·2	293	2	0·7	1,456	8	0·5	− 13·1	+ 26·8	..
Control ..	..	5	98·8	94·0	0·48	4·08	93·0	186	80	43·0	844	268	31·7	..	..	..
Formalin, 1 in 40, presoak	4	5	98·7	91·2	0·44	3·96	89·5	358	0	0	1,639	0	0	− 1·9	+ 42·8	..
Control ..	..	5	98·8	90·0	0·82	4·07	90·5	181	89	49·2	827	255	30·8	..	..	..
Clarke's Wheat Protector	4	5	97·3	90·5	1·60	4·14	87·2	349	2	0·5	1,631	4	0·2	+ 1·1	+ 42·3	..
Control ..	..	5	98·8	93·0	1·15	3·94	90·0	180	74	41·1	785	215	27·5	..	..	..
Semesan dust	2	5	99·3	95·0	0·83	4·11	89·7	359	0	0	1,641	0	0	+ 2·7	+ 36·2	..
Control ..	..	5	98·8	87·5	..	4·01	87·0	174	54	31·0	813	177	21·7	..	..	..

* Percentage calculated after deducting loose-smutted plants from total.

throughout the South Island for the control of cereal smuts. It costs about 2d. per bushel of seed treated.

Method of Treatment used in Experiments.—This followed as closely as possible the directions printed on the packet. The smutted seed was thoroughly wetted with solution made up in the proportion of one part Protector to fifteen parts water. It was kept moist for one hour, and then spread out to dry on blotting-paper in the laboratory, later being put into paper packets for transport to the sowing-ground at Ashburton.

Summary of Experimental Results.—(*a*.) Effect on the smut: Complete control was obtained with the low and medium infection of the Pearl, Hunter's, and Purple-straw Tuscan. With the high infection of the Solid-straw Tuscan, 0·2 per cent. of smutted heads remained, as against about 30 per cent. in the controls.

(*b*.) Effect on the wheat-plant: This differed widely as between the Pearl and Hunter's sown in the autumn and the two Tuscans sown in the spring. With the former, Clarke's Wheat Protector had a very depressing effect on germination and vigour of the seedling, while with the latter the treated seed improved slightly in both respects over the untreated controls. This profound difference in behaviour is more likely to be due to some error in treatment of the Pearl and Hunter's than to the different dates of sowing. Further work is necessary to settle the point.

Practical Considerations.—The simple and concise directions for use printed on each packet are a great factor in the popularity of this well-known treatment.

USPULUN.

Uspulun is the trade name of a preparation of mercury chlorophenate manufactured by Friedr. Bayer and Co., Leverkusen, Germany. Reports state that it is widely used as a seed-disinfectant in Europe and South America. It is claimed for Uspulun that, while giving perfect control of stinking-smut, it not only does not injure the seed but actually improves both germination, vigour of plant, and yield. The British agents are Millwards Merchandise, Ltd., Manchester, and the price about 13s. per pound, or about 9¼d. per bushel of seed treated.

Method of Treatment used in Experiments.—This follows closely the directions of the makers. The smutted seed was steeped for one hour in a 0·25-per-cent. solution of Uspulun, and then spread out on blotting-paper to dry.

Summary of Experimental Results.—(*a*.) Effect on the smut: Complete control of stinking-smut was given by the Uspulun treatment in all the experiments.

(*b*.) Effect on the wheat-plant: The experiments fully bear out the claims of the makers that wheat-seed treated with Uspulun gives a higher percentage germination in the field and greater vigour in the seedling than untreated seed. With the older seed of Pearl, Hunter's, and Purple-straw Tuscan there was also an increase in number of heads harvested, but with the newer Solid-straw Tuscan a very slight reduction.

Practical Considerations.—The relative advantages and disadvantages of the three similar seed-disinfectants, Uspulun*, Germisan, and Semesan, will be considered together under the heading of Semesan.

GERMISAN.

Germisan is the trade name of a preparation of mercury-cresol-sodium cyanide manufactured by the Saccharin-Fabrik, Aktiengesellschaft, vorm. Fahlberg, List and Co., Magdeburg, Germany, the British agents being Ronsheim and Moore, London. Like Uspulun, it is claimed to control stinking-smut and stimulate the wheat-plant. The price is about 8s. per pound, or about 5½d. per bushel of seed treated.

Method of Treatment used in Experiments.—The smutted seed was steeped for half an hour in a 0·25-per-cent. solution of Germisan, and then spread out on blotting-paper to dry.

Summary of Experimental Results.—(*a.*) Effect on the smut: Complete control of stinking-smut was given by the Germisan treatment in all the experiments.

(*b.*) Effect on the wheat-plant: With the Pearl, Hunter's, and Purple-straw Tuscan the percentage germination was higher than that of the untreated controls; with the Solid-straw Tuscan it was slightly lower. In all, the vigour of the seedling was increased by the treatment, and the total heads harvested in all cases showed a substantial increase over adjacent controls.

SEMESAN.

Semesan is the trade name of an organic mercury compound manufactured by E. J. Du Pont de Nemours and Co., Wilmington, Delaware, U.S.A. The makers claim that, like Uspulun and Germisan, it will control stinking-smut and at the same time stimulate the wheat-plant. It can be used in solution as a steep, or as a dry powder mixed with the seed. The price is about 13s. 4d. per pound, or about 7d. per bushel by the steep method and about 10d. per bushel by the dry method.

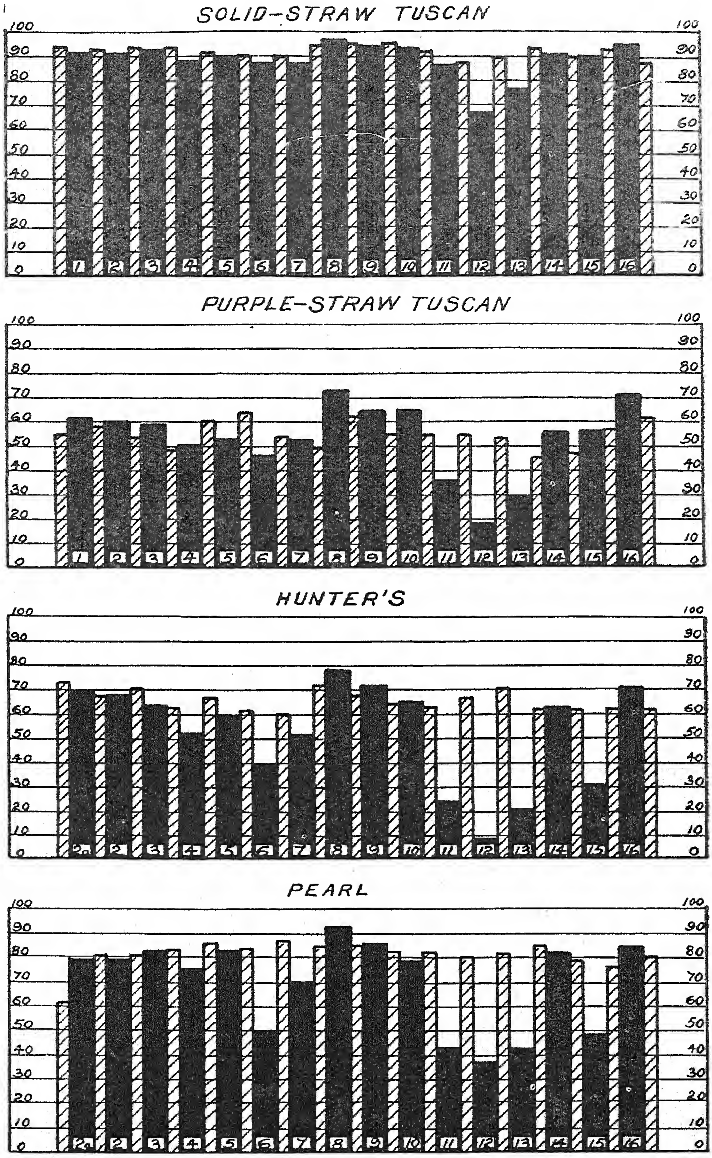
Method of Treatment used in Experiments.—(*a.*) Steep method: Smutted seed was steeped for one hour in a 0·2-per-cent. solution of Semesan, and then spread out on blotting-paper to dry.

(*b.*) Dry-dust method: Smutted seed was thoroughly shaken in a closed container with dry Semesan at the rate of 1 oz. per bushel of seed.

Summary of Experimental Results.—(*a.*) Effect on the smut: Complete control of stinking-smut was given by Semesan both by the steep and dry methods in all the experiments.

(*b.*) Effect on the wheat-plant: The differences in percentage germination and vigour of seedling between the seed treated by the steep method and the adjacent controls varied with the four wheat varieties, but on the whole were too small to be significant. In the total heads harvested the two Tuscans showed a substantial increase in favour of the treatment, and the Hunter's a very slight and the Pearl a greater decrease.

* The samples of Uspulun and Germisan used in these experiments were kindly procured for the writer by Dr. E. J. Butler, Director of the Imperial Bureau of Mycology, Kew, London.



GRAPHICAL PRESENTATION OF THE FIELD GERMINATIONS RECORDED IN TABLES 1–4.

Key to Numbers.—(1) Copper carbonate. Corona Coppercarb, 4 oz. per bushel. (2*a*) Copper carbonate, Stauffer's, 4 oz. per bushel. (2) Copper carbonate, Stauffer's, 2 oz. per bushel. (3) Copper carbonate, Bowden Bros., 2 oz. per bushel. (4) Bluestone, 1 lb. in 10 gallons water. (5) Bluestone, 1 lb. in 10 gallons plus limewash. (6) Bluestone, 1 lb. in 5 gallons water. (7) Bluestone, 1 lb. in 5 gallons plus limewash. (8) Uspulun, steeped 1 hour in 0·25 per cent. solution. (9) Germisan, steeped ½ hour in 0·25 per cent. solution. (10) Semesan, steeped 1 hour in 0·2 per cent. solution. (11) Hot water, presoaked 6 hours at 63° F.; dipped 10 minutes at 125° F. (12) Formalin, 1 pint in 40 gallons water (1–320); dipped 10 minutes. (13) Formalin, 1 pint in 60 gallons water (1–480); dipped 10 minutes. (14) Formalin, presoaked 6 hours; dipped 10 minutes in 1–320 and rinsed. (15) Clarke's Wheat Protector, wetted with 1–15 solution. (16) Semesan, dusted at 1 oz. per bushel. Untreated (controls) indicated by cross-hatching.

The dry-dust method gave a substantial increase in percentage germination, vigour of seedling, and totals heads harvested in all the experiments.

Practical Considerations.—The three related disinfectants, Uspulun, Germisan, and Semesan, open up a new field in seed-treatment. In the present experiments not only are they perfect controllants for stinking-smut, but they have shown a remarkable stimulation of the growth of the plant. How far under farm conditions this stimulation will be reflected in increased crop remains to be decided. If the number of heads harvested per hundred seeds sown can be accepted as a guide, then, for instance, the dry Semesan treatment, giving an average increase over the untreated seed of 8 per cent., or $3\frac{1}{5}$ bushels on a 40-bushel crop, would amply repay the outlay in material and labour without any reference to smut-control. The long-time steep recommended is a serious practical handicap to the wet treatments, but this objection is eliminated with Semesan by the simple and apparently more effective dry-dust method.

Table 5.—Incidence of Stinking-smut in relation to Date of Sowing.

Date of Sowing.	Plants.			Heads.			Plants showing Loose Smut.	Ashburton Meteorological Records.		
	Total.	Smutted	Percentage smutted.	Total.	Smutted	Percentage smutted.		Week ending	Mean Temp. F.	Total Rainfall.
1924.								1924.		Inches.
..	..	..	..	..	..	..	..	May 17	50·7	0·04
May 17	133	2	1·5	1,048	11	1·0	6	,, 24	47·3	0·40
,, 24	113	2	1·8	1,056	8	0·7	3	,, 31	47·5	0·84
,, 31	107	16	15·0	803	98	12·2	2	June 7	41·6	0·69
June 9	108	38	35·2	815	230	28·2	2	,, 14	45·0	0·61
,, 14	95	27	28·4	692	181	26·1	1	,, 21	39·9	0·24
,, 21	47	5	10·6	507	67	13·2	0	,, 28	40·5	0·31
,, 28	56	10	17·8	538	105	19·5	0	July 5	42·1	0·06
July 5	74	12	16·2	612	97	15·8	0	,, 12	41·9	0·06
,, 12	90	9	10·0	685	56	8·2	2	,, 19	43·9	0
,, 19	101	15	14·8	683	82	12·0	1	,, 26	37·9	0·24
,, 26	75	8	10·6	473	57	12·0	1	Aug. 2	44·9	0·25
Aug. 2	103	4	3·9	640	18	2·8	1	,, 9	41·0	0·37
,, 9	114	19	16·6	521	70	13·4	0	,, 16	46·1	0·33
,, 16*	131	15	11·4	667	46	6·9	0	,, 23	42·9	0·09
,, 23*	130	19	14·6	570	51	8·9	1	,, 30	48·5	0·01
,, 30	79	4	5·0	554	26	4·6	0	Sept. 6	46·7	0·21
Sept. 9	80	2	2·5	498	10	2·0	2	,, 13	47·6	0
,, 13	63	2	3·2	313	5	1·6	1	,, 20	54·3	0
,, 20	124	0	0	538	0	0	8	,, 27	53·3	1·04

* In these two sowings the seeds were planted 1 in. apart, 400 seeds being sown instead of 200 as in the other sowings of the series.

Mean of Controls in Table 3.—Dates of sowing, August 5 and 7. Plants—total, 103·8; percentage smutted, 9·8. Heads—total, 688; percentage smutted, 7·2. Plants showing loose smut, 1·7.

The above data (Table 5) are founded on weekly sowings of 200 seeds of Purple-straw Tuscan wheat, 1923 harvest, inoculated in bulk with one part of smut spores (*Tilletia Tritici*) to 750 parts by weight of seed. The sowings were carried out by Mr. J. G. McKay at the Ashburton

Experimental Farm, and the temperature and rainfall records taken by Mr H. P. Clayton at the Meteorological Station distant about two miles over flat country from the place of sowing.

In the absence of soil temperature and moisture determinations on the spot, the only safe conclusions to be drawn from the table are that the percentage of infection given by similar seed varies widely according to conditions at the time of sowing, and that sowings made during the three winter months of June, July, and August are more likely to be heavily infected than those sown earlier or later.

The table is also useful in throwing some light on the wide differences in infection recorded for the four varieties in Tables 1–4. It is apparent that these differences are not necessarily due to a difference in varietal susceptibility, but in part at least may be caused by environmental differences during germination.

RIGHT HONOURABLE WILLIAM FERGUSON MASSEY, 1856–1925.

THE *Journal* records its sincere tribute to the memory of the late Prime Minister, who, though better known of late years in the wider policies of State, was so intimately associated with the great basic industry of the land. When, in 1912, Mr. Massey formed his first Ministry it was fitting that, a farmer himself, he should take the portfolio of Agriculture in addition to the Premiership. He thus became the sixth Minister of Agriculture, and continued to administer the Department for the following three years, when the advent of the National Government, in 1915, caused a redistribution of offices. During Mr. Massey's term the activities of the Department of Agriculture were developed in various directions, while a notable related measure of his regime was the creation of the Board of Agriculture. At this period he also held the portfolio of Lands with its wide rural scope. But Mr. Massey's direct influence on agricultural interests did not end in 1915. During the war period he was closely connected with the Imperial requisitions of our primary produce and related shipping affairs. More recently he became a force behind the export-produce-control movement. The welfare of the man on the land was ever to Mr. Massey a matter of true concern. His manifold service for the agricultural community will be kept in grateful remembrance.

QUEEN-BEE REARING.

NEW MATING-BOX TESTED AT RUAKURA.

A. B. TRYTHALL, Apiarist, Ruakura Farm of Instruction.

THE question of the most suitable mating-box has proved a prolific field for experiment ever since queen-rearing became a prominent part of apiary-work. The gist of the matter is to mate queens successfully with the least amount of attention and the minimum of worker bees.

During a lengthy experience in beekeeping I may claim to have tried practically every kind of mating-box that other beekeepers have advocated, and before describing my latest experiment it will be advisable to review some of the more prominent appliances that have been used previously.

The first and probably still the most commonly used form of mating-box is the ordinary three, four, or five Langstroth frame nucleus hive; and for practical purposes—particularly in the case of those beekeepers who only need to rear queens for their own requirements—this is still one of the best and safest boxes to use for the purpose. These nuclei, however, require a great many bees for stocking, and as queens can be mated in much smaller nuclei containing far fewer bees it is only natural that the breeders of large numbers of queens should have been constantly experimenting to discover how small a box, with how few bees, can be used to do the same work easily and well.

Over twenty years ago an American beekeeper named Pratt, who wrote for the bee journals and issued a series of pamphlets on queen-rearing under the *nom de plume* of "Swarthmore," used mating-boxes of very small dimensions. These boxes contained two frames little larger than 1 lb. section frames, and were stocked with a queen-cell and a breakfast-cupful of bees only. Many beekeepers, including myself, tried these so-called "baby nuclei," but with only partial success, the fault being that in many instances the bees swarmed out with the young queen when she took her mating flight—and never returned.

The A.I. Root Company (U.S.A.), recognizing that "Swarthmore" had gone to too great an extreme, designed what is known as the "Root Twin Baby Nuclei," which consists of a box $9\frac{1}{4}$ in. by $8\frac{1}{2}$ in. by $6\frac{5}{8}$ in. deep, inside measurement. This is divided in the centre by a fixed partition, forming two compartments with separate entrances at each end. The frames have sliding tin ends to rest on the rabbets of the hive. The sliding ends when pushed back enable three of these frames to be fitted into a Langstroth frame, so that the combs could be worked out and brooded in an ordinary hive. When brooded and stocked with honey two of the small frames are placed in each compartment of the twin baby nuclei, together with a queen-cell and about a pint of bees.

I have used these twin baby nuclei quite successfully at Ruakura, and they are still used in America by many queen-rearers, but for several reasons have not been so successful as was expected. Among

other disadvantages are the following: (1) They are too small to winter as separate units, and therefore require to be restocked every season; (2) owing to the small capacity of the frames, constant supervision is necessary to prevent starvation on the one hand, or undue honey-glutting of the frames on the other; (3) unless stocked at an out-yard and released in the home yard (or *vice versa*) there is the risk of too many bees deserting; (4) the trouble entailed in making the small frames and getting them worked out in Langstroth frames and afterwards transferred to the baby nuclei.

THE NEW MATING-BOX.

During the last two seasons I have been experimenting with a nucleus hive made out of benzine- or kerosene-case ends, and of dimensions to take ten frames the size of a Langstroth frame cut in half horizontally. These hives have provision for four entrances, one on each side and end, and are capable of being divided into any number of compartments, up to four, by slipping in movable division-boards made of three-ply wood flanged with strips of rubber tubing to provide a tight-fitting cushion. The floor-board is movable, but fastened in position when necessary with four wire pins. Entrance shutters are provided to close any compartments not in separate use.

Details of Construction.

Details of the construction of this hive are as follows:—

Floor-board: This is 19⅜ in by 11¾ in., and composed of two benzine-case ends cut to size and nailed on 1 in. bearers all round. The scraps cut off provide more than enough to form short legs, which are nailed to the under-side. On top of the floor-board, 1 in. from each end, are nailed pieces of wood 1 in. square and the width of the hive. In the centre of each of these is cut a small hive-entrance.

Body-box: Sides—one complete benzine-case end each, with frame rabbet $\frac{7}{16}$ in. deep by ⅜ in. cut out. Ends—one case end each, reduced to 11⅝ in. When nailing together let the ends lap the sides, instead of letting the sides lap the ends. In the ends cut entrances corresponding to those in the floor-board. At each side bore auger-holes 9 in. from end of box (outside measure), such holes being placed diagonally (not opposite) to each other. The box should fit comfortably between the pieces on each end of the floor-board. Bore four gimlet-holes through these end pieces and the hive ends, and insert fence-wire pins to hold the box and floor-board firmly together.

The division-boards of the box are made of three-ply wood, 9½ in. wide by 9¼ in. deep. Along the bottom and projecting ½ in. from the wood is a strip of motor-car inner-tube rubber 10½ in. long, and similar pieces 9¼ in. long project in the same way down each side. These are tacked firmly to the three-ply with strips of thin wood. A similar strip runs along the top edge, with ends projecting to fit the rabbets of the hive. The gist of the whole arrangement is to keep the bees not only from passing the division-boards but to prevent any communication between the compartments, and yet for the division-boards to be easily removable and not subject to propolization.

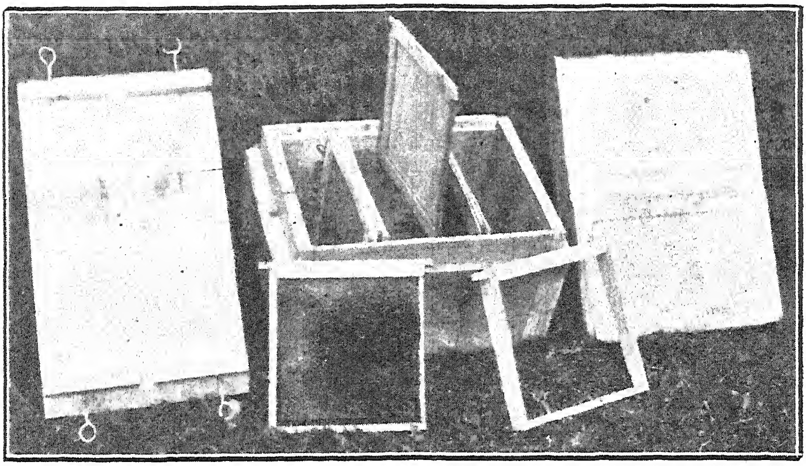


FIG. 1. SHOWING THE PARTS OF THE NEW MATING-BOX AND HIVE.

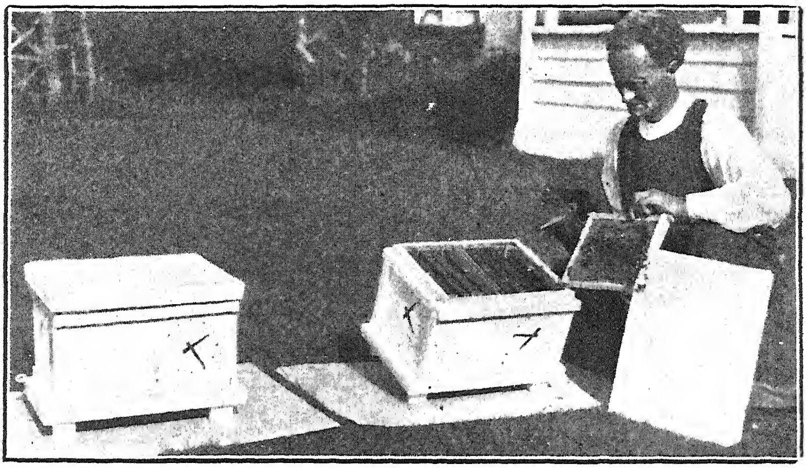


FIG. 2. THE NUCLEUS HIVE IN USE BY MR. TRYTHALL AT RUAKURA APIARY.

The clock-faces on each compartment of hive are devised to indicate condition of nuclei when last examined, and thus largely save note-taking. The meanings attached to each hour (which are memorized) are as follows: (1) Empty; (2) query; (3) queen-cell required; (4) queen-cell given; (5) cell refused by bees—own cell built; (6) cell hatched; (7) young queen seen, but not yet laying; (8) no queen—fertile workers present; (9) queen laying—untested; (10) mismated queen; (11) tested queen; (12) more bees or stores required. The minute hand pointing to any one of first thirty minutes indicates respective day of month when last examination made; pointing to any one of second thirty minutes it indicates necessity of examining hive again at that future date. Hands are readjusted at completion of each examination as required.

[*Photos by H. Drake.*

Roof: This is made with $\frac{7}{8}$ in. square bearers all round, giving inside measurements of $16\frac{1}{16}$ in. by $11\frac{7}{8}$ in. Cover with double thickness benzine-case side timber, and over all cover with benzine-tin sheet cut as shown in Fig. 1. Flatten out the tin, and solder small V-shaped pieces into the breaks on each side. Give $1\frac{1}{2}$ in. lap to the tin all round. The double thickness of roof-timber gives weight and stability, with less liability to being blown off, and also more protection against summer heat and winter cold. Instead of hand-holes for lifting, a flange of $\frac{7}{8}$ in. square wood is run right round the outside of the hive-body 1 in. below the top. The roof-sides rest on this flange, which also tends to further prevent the roof from being blown off if the hive is exposed to strong winds.

The hive should be put together with all case-marks turned to the inside. Paint all over with three coats, giving the tin part of the roof a coat of red-lead paint inside before nailing on so as to prevent it rusting from the inside. The final product is a neat, durable, compact hive which will last for years.

Stocking and Management.

To stock the mating-box take from some other hive or hives five Langstroth frames containing brood and stores, and with a fine saw cut them in two exactly in the centre. Then nail on to each half another end bar on which has been previously nailed a projecting end to rest on the rabbet on the hive-side. Place the ten half-size frames in the hive, and cover with quilt and roof. Pull out the wire pins, lift the body off its floor-board, and place it crossways over the excluder on a strong colony of bees, covering the vacant space with a board 16 in. by 8 in. The young nurse-bees from the strong hive will immediately take charge of the brood, and the nucleus hive can be moved back on to its own floor-board the next day, and be placed on a new stand. The young bees, never having flown, will remain where they are put.

The hive is now ready to receive one, two, three, or four queen-cells according to requirements. If more than one queen-cell is given, divide the hive accordingly by slipping in one or more of the three-ply rubber-cushioned dividing-boards, and open the required number of entrances. These division-boards take up very little space, and even if one compartment is reduced to two frames only in size it has still much more capacity than one of the Root baby nuclei. If any compartment becomes weaker in bees than another, turn the hive round, bringing the entrance to the weakest portion opposite the strongest flow of field-bees. But care should be taken to do this when no young queens are due to fly, or matters will be complicated for them.

As the close of the season approaches and surplus queens are being used up for requeening other hives or for sale purposes, it is the simplest matter to remove a queen from one of these compartments and the following day to take out a partition, thus uniting its bees and brood with the next. This in turn is treated likewise, until one queen only is left in possession of the entire hive, in which she should be able to winter easily and come out strong in spring. Then the partitions and queen-cells are put in again with the minimum amount of trouble, nuclei being all ready at the start without having to re-stock them every spring.

Advantages summarized.

The points in favour of this mating-box are many, and may be summarized as follows: (1.) It is made almost entirely of waste material —benzine-case timber and container-tin. (2.) Well made and painted, it is a good-looking hive, and very substantial, durable, weatherproof, and warm. (3.) It is ideal for wintering. (4.) It is convenient to hive small or medium-sized swarms in. (5.) Its elasticity of method; if the beekeeper has surplus queen-cells he can use them by placing division-boards in the box; as queens are used the division-boards are taken out and the compartments united.

Another easy way to provide nuclei is to fill the half-size frames with foundation, and after filling the hive with them to place a swarm in possession. Later on, when the swarm has built out and brooded the frames, partitions can be inserted and queen-cells given.

IMPORTATION OF FERTILIZERS IN 1924-25.

ANNUAL STATISTICS AND NOTES.

F. T. LEIGHTON, Analyst, Chemistry Section, Agriculture Department.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1925, are now (by the courtesy of the Comptroller of Customs) available for study, and, with other data, have been compiled for the *Journal* in the accompanying tables.

The most notable feature of the year's returns is the marked increase in the importation of phosphatic fertilizers. Of rock phosphate or guano (the terms may now be regarded as practically synonymous in trade) 32,000 tons more were imported than in 1923-24, or over 40 per cent. Of the 108,000 tons of rock phosphate imported probably about one-half was utilized in the manufacture of superphosphate, and the remainder marketed as finely ground raw phosphate, either alone or in proprietary mixed fertilizers. As stated in the *Journal* for May, 1924, much of the efficacy of rock phosphate depends on the fineness of grinding, and users are invited to forward to the Department's Chemical Laboratory, Wellington, for examination and report, any samples they consider are not ground to the requisite fineness, which may be taken as equal to that of good-quality basic slag.

The Dominion's demand for superphosphate is now completely satisfied by New Zealand manufacturers, the aggregate importations for the past three years amounting to only 265 tons.

The importations of basic slag for the past year also constitute a record. The greater part (about two-thirds) of the slag received was of Belgian origin, the remainder, except for a few hundred tons, coming from the United Kingdom. No American basic slag has been imported this year. So far as can be determined by chemical analysis of the samples received, practically no low-grade slag is coming to New Zealand, samples examined being of satisfactory quality in total and citric-acid-soluble phosphate, also in fineness of grinding. No samples of fluorspar slags, which contain some of their phosphate in a form which is of little value to plants, have come under the notice of the Department during the year. Field experiments have shown that basic slags

in the making of which fluorspar has been used are often of comparatively small manurial value, while chemical analysis reveals that only a small percentage of the total phosphate is soluble in the official 2 per cent. citric-acid solution.

Potash salts are also being imported in increasing amounts, this year's importations being 50 per cent. above those for the preceding period.

The very small demand in New Zealand for soluble nitrogenous fertilizers is indicated by the returns of sulphate of ammonia and nitrate of soda imported. The small quantities which have come to hand are probably used almost entirely in intensive cultivation (market gardening, &c.), and in the preparation of special proprietary mixtures.

TABLE I.—SUMMARY OF FERTILIZER IMPORTATIONS, 1924–25 AND 1923–24.

Fertilizer.	Quantity.		Declared Value.	
	Year 1924–25.	Year 1923–24.	Year 1924–25.	Year 1923–24.
	Tons.	Tons.	£	£
Bonedust	2,452	4,158	23,210	39,541
Bone-char	396	50	1,756	447
Basic slag	45,682	39,632	137,213	124,565
Superphosphate	10	255	29	985
Rock phosphate (raw) and guano	108,163	76,517	150,340	108,119
Egyptian basic phosphate	8,530	5,996	25,313	18,138
Kainit	4,001	3,975	9,137	9,557
Muriate of potash	2	..	17	..
Sulphate of potash	1,126	863	11,574	9,241
Potash, other	2,287	290	8,321	1,314
Gypsum	354	1,979	574	2,583
Sulphate of ammonia	841	842	13,158	5,439
Nitrate of soda	816	748	9,751	9,646
Sulphate of iron	96	63	1,043	549
Fertilizers unspecified	12	15	1,371	265
Totals	174,768	135,383	392,807	330,389

NOTE.—With regard to the "declared values" given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not cover the present freight, insurance, and other charges, the statistical value is less than the actual landed value."

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1915–25.

Year ended 31st March.	Bonedust.	Basic Slag.	Superphosphate.	Raw Rock Phosphate and Guano.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons.	Tons.
1915	7,966	29,385	54,190	23,983	Nil.
1916	10,059	10,339	58,013	39,366	2,026
1917	10,386	6,660	31,962	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	,,
1924	4,158	39,632	255	76,517	5,996
1925	2,452	45,682	10	108,163	8,530

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR ENDED 31ST MARCH, 1925, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.			Chile.	India.	Pacific and Indian Ocean Islands.		United Kingdom.			Belgium.		France.		Germany.		Egypt.	Netherlands.
	Nitrogenous Manures.	Bonedust and Chardust.	Gypsum.	Nitrate of Soda.	Bonedust.	Name of Island.	Rock Phosphate.	Nitrogenous Manures.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Phosphate.	Basic Slag.
Auckland ..	405	1,052	30	765	1,475	New Caledonia ..	1,817	100	6,769	1,082	19,226	174	105	298	250	2,175	998	201
						Nauru	52,720											
						Ocean	11,379											
						Makatea ..	605											
New Plymouth ..	..	..	..	..	..	New Caledonia ..	958	..	9,819	842	2,271	..	..	..	..	660	..	..
Wanganui ..	..	..	..	..	..	New Caledonia ..	712	..	..	..	..	..	..	..	..	..	..	..
Napier	..	..	..	..	..	..	..	..	150	25	..	..	..	..	..	15	..	..
Wellington ..	21	..	15	50	70	..	..	..	2,932	161	2,320	25	..	80	..	240	3,590	..
Nelson	..	..	..	..	..	..	..	..	330	..	102	..	..	66	..	..	..	..
Lyttelton ..	225	..	..	..	..	Nauru	20,469	..	150	..	85	..	..	465	..	97	1,100	..
						New Caledonia ..	700											
Timaru	..	..	..	..	..	New Caledonia ..	714	..	..	70	..	..	..	105	..	..	..	..
Dunedin ..	38	..	309	..	..	Nauru	9,310	25	50	115	75	..	..	140	..	220	1,500	..
						New Caledonia ..	1,415											
Invercargill ..	22	251	..	..	..	Nauru	5,500	..	439	75	408	..	..	210	..	75	1,342	..
						New Caledonia ..	1,839											

NOTE.—For the previous year's corresponding table see *Journal* of May, 1924.

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR 1924.

NELSON R. FOY, Seed Analyst, Biological Laboratory, Wellington.

FOR the twelve months ended December, 1924, 8,266 samples were submitted to the Seed-testing Station for germination tests. Of these samples 1,236 were also analysed for purity. In addition, approximately 500 miscellaneous laboratory tests were made, and 125 samples were received from farmers. A decrease on the number tested for the previous year is shown, this probably being attributable to the fact that the seed-export trade was not so active during 1924, particularly in perennial rye-grass. Crested dogstail may be excepted, as New Zealand seed of this species was in considerable demand overseas.

Table 1 shows the movement of the testing-work throughout the year, and Table 2 gives an indication of the activities of the seed trade compared with 1923.

Table 1.—Number of Samples received in the Different Months, 1924.

Month.	Number.	Month.	Number.
January	556	July	469
February	748	August	699
March	866	September	1,014
April	853	October	556
May	938	November	506
June	650	December	411

Table 2.—Number of Samples received of the various Species, 1923 and 1924.

Seed.	1924.	1923.	Seed.	1924.	1923.
Lucerne	103	97	Paspalum	56	34
Alsike	74	74	Poa pratensis	51	46
White clover	293	325	Prairie-grass	19	21
Cow-grass and red clover..	439	405	Other grasses	72	160
Crimson clover	25	36	Japanese millet ..	32	40
English trefoil	27	34	Oats	42	42
Lotus major	50	63	Other cereals	35	18
Other clovers	49	36	Mangolds	208	184
Perennial rye-grass ..	1,031	1,537	Turnips	417	413
Italian rye-grass ..	255	370	Swedes	133	278
Western Wolths ..	176	201	Rape	86	145
Timothy	69	76	Kale (Buda and Thousand-headed)	39	48
Crested dogstail.. ..	641	90	Chou moellier	34	..
Danthonia spp.	47	81	Tree-seeds	20	16
Brown-top	54	78	Flower-seeds	24	20
Chewings fescue.. ..	490	524	Vegetables (other than peas)	410	325
Meadow-fescue	33	35	Peas	260	179
Meadow-foxtail	49	43	Tares, vetches, &c. ..	16	26
Yarrow	12	..			
Cocksfoot	516	610			

GRASSES.

The average percentage purity and germination of the main grasses are shown in Table 3.

Rye-grasses.—The averages for perennial Italian and Western Wolths are all higher than those recorded for 1923, as was also the yield at harvest. In contrast to 1923 the demand for seed did not equal the supply, and consequently there has been in some districts a fair carry-over into 1925. Table 4 shows the average growth of perennial rye-grass by districts. Sandon is again disappointing, and the failure of the seed from this district to germinate satisfactorily is being investigated at this Station.

Cocksfoot.—Fair average quality characterized this seed. Danish generally is of a higher growth than New Zealand seed, the average shown in Table 4 being thrown out by a few very inferior lines. A reduction every year in the yields of Akaroa seed is followed naturally by an increase in the importation of Danish. This is a regrettable state of affairs, but is inevitable with the increase of dairying on Banks Peninsula. The more continuous grazing not only tends to lessen seed-production, but, given sufficient time, will alter the constituent character of these famous Cocksfoot pastures.

Timothy.—All imported seed of this species was of good quality.

Crested Dogstail.—The dogstail crop was of good average quality. Southern seed, however, did not hold its germination capacity very well abroad. This seed is famous for its colour, and English buyers are beginning to discover that colour is not always the most desirable characteristic of dogstail. A light colour usually denotes either immaturity or a forced ripening out of the head. Such seed rarely holds its growth for any great length of time, and shipment conditions probably tend to accentuate this feature. Southland growers would do well to leave the seed in stook a week or so longer, or, where practicable, delay cutting a few days.

Danthonia.—The quality was fair. A large number of very rough samples were received, some containing up to 60 per cent. of hair-grass, rye-grass, and inert matter (straws, &c.). There now appears to be a tendency to label this seed with the additional specific names *pilosa* or *semiannularis*, reserving the generic name for mixtures of the two species.

Brown-top.—The quality was irregular, ranging from extraordinarily poor to particularly good. Some of the samples did not contain sufficient filled seed to enable the standard germination test to be made. It is high time that the blower was put on to all brown-top. In this connection it is reported that some firms are dressing this seed up to its full weight for export. If the American trade is to be encouraged and retained a fancy grade of seed will have to be used for the purpose. In the dressed state brown-top is superficially the same in appearance as American red-top, and farmers when buying the cleaned seed should make sure it is New Zealand brown-top that is being offered to them. Determinations of Agrostis species are made gratis at this Station.

Chewings Fescue.—The samples received were of good average quality. This seed is important mainly from an export point of view, being now of little account in New Zealand pastures generally.

Table 3.—Average Percentage Purity and Germination of the Main Grass-seeds.

Seed.	Average Percentage of Impurities.	Percentage of Germination.			Percentage of Samples germinating between					
		Highest.	Average.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.
Perennial rye-grass..	2·7	100	86	8	3	2	8	16	28	43
Italian rye-grass ..	0·4	100	87	3	3	3	5	8	18	63
Western Wolths ..	0·2	100	90	9	5	1	1	1	16	70
Timothy	0·5	99	90	28	3	0	2	6	14	74
Crested dogstail ..	0·7	100	87	10	3	1	3	10	31	53
Cocksfoot	3·3	97	62	0	20	20	24	21	14	2
Brown-top ..	3·0	96	61	8	28	15	15	18	18	3
Chewings fescue ..	1·0	97	80	1	6	3	8	20	39	25
Meadow-fescue ..	0·2	97	58	0	50	3	6	12	12	18
Poa pratensis ..	0·5	83	52	2	32	42	18	6	2	2
					0–20.	21–30.	31–40.	41–50.	51–60.	61–100.
Meadow-foxtail ..	5·0	85	30	3	26	28	24	16	2	2
Danthonia spp. ..	17·8	83	36	2	24	24	2	3	2	10
Paspalum.. ..	0·2	84	36	0	40	9	4	5	20	23

Table 4.—Average Percentage Purity and Germination of Perennial Rye-grass, Crested Dogstail, and Cocksfoot, according to District of Origin.

Seed.	Average Percentage of Impurities.	Percentage of Samples germinating.			Average Germination.	Number of Samples.
		81–90.	91–100.			
		Perennial Rye-grass.				
Southern	0·8	33	35		84·3	377
Canterbury	0·3	15	66		91·0	226
Sandon	0·1	36	28		82·4	157
Hawke's Bay	0·5	8	84		93·5	61
Poverty Bay	0·5	5	80		94·0	23
		Crested Dogstail.				
Southern	0·8	34	50		88·0	486
Sandon	0·1	24	65		90·2	75
		Cocksfoot.				
		51–70.	71–80.	81–100.		
Plains	2·0	40	40	16	68·2	24
Akaroa	1·3	58	16	11	62·8	100
Danish	1·2	36	22	25	66·2	152

Paspalum Dilitatum.—Quality in general was good, some samples growing over 90 per cent. All the high-grade seed received was of Australian origin, most of these samples being direct from Australian seed firms.

Poa Pratensis.—Samples were of fair average quality, most of the seed being of American origin. The few samples of New-Zealand-grown seed all germinated over 90 per cent.

Other Grasses, &c.—Average germination percentages of the species included under this heading were as follows: Fine-leaved fescue, 50·0; tall fescue, 74·5; sheep's fescue, 58·5; red-top, 75·2; Indian doob, 82·0; Poa nemoralis, 49·0; Poa trivialis, 44·0; Yorkshire fog, 87·8; yarrow, 67·8.

Table 5.—Occurrence of the Main Impurities of the Grasses.

Impurities.	Perennial Rye-grass.	Italian Rye-grass.	Western Wolths.	Timothy.	Crested Dogstail.	Cocksfoot.	Brown-top.	Chewings Fescue.	Danthonia.
Hair-grass	74	58	57	..	29	23	50	36	100
Goose-grass	72	71	55	..	..	69	..	13	40
Catsear	25	10	5	..	61	17	58	80	65
Perennial rye-grass ..	..	..	..	..	75	93	14	76	80
Sweet vernal	11	3	1	..	20	1	28	49	75
Rib-grass	13	16	16	10	7	71	22	4	85
Yorkshire fog	23	20	22	..	90	62	28	64	80
Sorrel	35	39	30	55	23	34	65	26	45
Curled dock	11	13	..	..	..	17	..	2	..
White clover	15	12	5	40	15	15	..	4	..
Creeping-buttercup ..	1	..	..	..	..	17	..	..	..
Californian thistle ..	..	..	2	..	29	..	..	2	..
Hawkweed	..	..	6	.	36	9	14	..	..
Ergot sclerotia	35	10	..	30	24	7	36	10	..
Ox-eye daisy	..	..	..	..	..	10	7	..	..
Cocksfoot	22	23	11	..	19	..	..	21	..
Fat-hen	..	..	..	50	..	5	..	..	..
Italian rye-grass.. ..	73	..	..	..	..	14	..	..	..
Suckling-clover	24	38	22	..	..	9	29	4	42
Crested dogstail	19	3	..	..	..	3	7	20	37
Chickweed	1	..	..	..	7	3	42	..	..
Field-madder	..	1	..	..	..	..	..	..	..
Alsike	4	..	..	100	2	1	..	1	..
Lotus spp.	1	..	2	..	1	..	93	..	2
Cow-grass	4	1	5	10	1	20	7	1	4
Toad-rush	2	2	..	1	4	2	79	3	6

CLOVERS, ETC.

The average purity and germination percentages of the main clovers, &c., are shown in Table 6.

White Clover.—This was of the usual high standard of quality. Dodder occurred in 14 per cent. of the samples examined, compared with 5 per cent. in 1923. Dodder was noted in a fair number of the samples submitted for germination only, but as no regular examination is made of these no record is kept. The annual report of the Seed-testing Station for England and Wales for 1923 shows New Zealand white clover, when compared with that of other countries, at the top of the list for purity and germination. This statement is offset by the fact that half of the samples received by the Station in question contained dodder, usually in small amounts. The report further remarks that "this could easily be removed by suitable screening." It is doubtful whether any country pays more attention to seed-cleaning than does

New Zealand, but when dodder is in the seed crops no amount of screening will eliminate every seed of it from white clover. Crop inspection, or perhaps the use of the new electro-magnetic process of cleaning, would be a better proposition.

Table 6.—Average Percentage Purity and Germination of the Main Clovers, &c.

Seed.	Average Percentage of Impurities.	Percentage of Germination.			Percentage of Samples germinating between						Percentage of Hard Seeds.
		Highest.	Average.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.	
White clover..	3·5	99	87	10	4	1	1	6	43	47	12·5
Alsike ..	2·0	98	86	13	4	1	3	10	26	56	4·4
Cow-grass ..	0·6	100	91	15	2	1	2	2	21	72	4·6
Lucerne ..	0·4	100	89	61	0	0	2	15	28	56	7·9
English trefoil	0·1	97	74	23	19	11	11	11	0	49	4·0
Crimson clover	1·3	100	93	41	3	0	64	0	10	80	0·0
Lotus major ..	11·3	99	76	33	12	6	8	22	34	18	13·2

Alsike.—All imported seed was of good quality. Only two samples contained Californian thistle.

Cow-grass and Red Clover.—These were of good quality, and practically all samples were New Zealand seed. In the English report referred to above, New Zealand red clover (cow-grass) is shown in comparison with that of five other countries. Like our white clover, it leads in purity and germination, but is third on the list with 25 per cent. of the samples containing dodder. As regards samples examined at this Station, only 5 per cent. contained dodder. Nearly eighty species of impurities were noted in cow-grass and red clover, most of them appearing in imported seed.

Lucerne.—All examined was high-grade seed. None of the samples contained dodder.

Crimson Clover.—With the exception of a few obviously very old samples, all were of high quality.

Lotus Major.—This was of fair average quality generally. Some of the imported seed was very dirty, discoloured, and high in dodder content. Northern (New Zealand) samples all contained Lotus hispidus, in quantities varying from 1 to 90 per cent. Dodder was also present in a number of these. Southern lotus major was of very high quality, although some of the samples contained ragwort.

Other Clovers, &c.—The average germination of the less common of these was as follows:—

	Germination Percentage.	Hard Seeds Percentage.
Strawberry-clover	86·0	21·0
Subterranean clover	70·3	22·0
Suckling-clover	62·6	13·0
Lotus corniculatus	56·5	10·0
Lotus hispidus	54·3	26·0

ROOTS AND CRUCIFEROUS FORAGES.

The next table gives all the necessary information for this class, there being little to comment upon.

Table 7.—Average Percentage Purity and Germination of the Main Roots and Cruciferous Forages.

Seed.	Percentage of Impurities.	Percentage of Germination.			Percentage of Samples germinating between					
		Highest.	Average.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.
Turnips ..	0·1	100	90	31	2	3	4	8	23	61
Swedes ..	0·1	100	86	33	2	6	7	12	27	46
Rape ..	0·1	100	90	46	1	0	4	8	34	52
Kale ..	0·1	100	80	30	10	3	10	13	28	36
Chou moellier	0·1	99	85	49	3	6	6	12	27	50
					0–50.	51–100.	101–150.	151–200.	201–250.	251–300.
Mangolds ..	0·1	272	147	46	0	10	42	41	3	1

CEREALS AND MISCELLANEOUS FORAGES.

The average germination percentages of these seeds were as follows: Wheat, 88·0; oats, 85·3; barley, 74·8; rye-corn, 74·5; maize, 87·5; Japanese millet, 88·9.

PEAS, BEANS, TARES, ETC.

Average germinations under this class were as follows: Peas, 92·3; beans, 83·9; tares, 86·5; vetches, 95·0; blue lupins, 65·0.

VEGETABLES.

The average germination percentages and number of samples of the main vegetable seeds dealt with are shown in the following list:—

Seed.	Number of Samples.	Average Germination.	Seed.	Number of Samples.	Average Germination.
Broccoli	.. 22	84·5	Marrow	.. 18	84·3
Cabbage	.. 35	79·5	Melon ..	.. 36	86·7
Celery ..	.. 8	55·0	Onion ..	. 39	60·0
Cauliflower	.. 21	71·2	Parsnip	.. 14	57·8
Carrot ..	.. 82	65·6	Pumpkin	.. 14	76·0
Cucumber	.. 13	88·4	Radish..	.. 19	84·2
Leek ..	.. 12	51·8	Spinach	.. 8	42·6
Lettuce	.. 13	83·0	Tomato	.. 12	96·5

For purposes of comparison, those interested are referred to the Seed Station report for 1923, which was published in the *Journal* for June, 1924.

Acknowledgment is made of the careful computation of the figures in this record by Mr. W. J. Cooch, of the Seed Station staff.

VARIATIONS IN THE PERCENTAGE OF BUTTER-FAT IN MILK.

A STUDY BASED ON NEW ZEALAND C.O.R. DATA.

W. N. PATON, Dairy Division, Wellington.

IV. YEARLY VARIATIONS.

YEARLY variations in test are those which occur in the average tests for different lactation periods. The average lactational or annual test is obtained by dividing 100 times the total of the butterfat by the total of the milk produced during one lactation period. For the purposes of certificate-of-record testing a lactation period is limited to 365 days.

It is not an easy matter for dairymen to ascertain what variations there are in the tests of cows from year to year, and to what factors they are due. A cow is rarely tested each year, and, besides, the number of records available from the regular testing of one herd is hardly adequate on which to base any deductions. However, when one has large numbers of records to investigate, the nature of the variations and the causing factors are more readily apparent. Owing to the smallness of yearly test variations, considerable difficulty is experienced, even with fairly large numbers of records, in discovering the nature and assigning the causes of the many variations. A good clue to their discovery is afforded by the results of the study of monthly test variations, because of the obvious connection between the two. Hence we have here to consider the same set of factors as set out in the preceding article of this series.

YEARLY VARIATIONS DUE TO BREED.

This question was treated to some length in the first article of this series—published in the *Journal* for September, 1924—to which readers are referred.

YEARLY VARIATIONS DUE TO TIME OF YEAR OF CALVING.

The average annual tests of the four chief breeds have been tabulated according to the season of the year in which the cows commenced test, and are given in Table 15. From a study of this table it is apparent that the figures for spring and autumn and summer and winter agree quite closely. For this reason they have been grouped as shown in the two right-hand columns of the table. With the exception of the Jerseys, the average tests indicate that cows commencing in the summer or winter months test higher than do those commencing in the spring or autumn.

The annual tests for each month of commencement are given in Table 16. Owing to the blanks in the Jersey and Ayrshire figures for April and May, no average figures have been supplied or these months. Furthermore, the respective numbers of records for the months of December to June (both inclusive) are rather small, and for this reason no great weight is attachable to the averages obtained from them. It is found that the averages for July, August, and September are slightly higher than the average of the four breeds for

Table 15.—Variation in Annual Tests of Cows of the Chief Breeds commencing during Different Periods of the Year.

Breed.	Spring.		Summer.		Autumn.		Winter.		Spring and Autumn.		Summer and Winter.	
	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.
Friesians	3·54	615	3·56	255	3·55	57	3·56	115	3·54	672	3·56	370
Milking Shorthorns ..	3·98	218	4·09	20	3·96	5	4·07	20	3·98	223	4·08	40
Ayrshires	4·12	75	4·14	27	3·74	3	4·18	8	4·11	78	4·15	35
Jerseys	5·69	134	5·50	18	5·79	4	5·56	7	5·69	138	5·52	25

Table 16.—Variation in Annual Tests of Cows of the Chief Breeds commencing during Different Months of the Year.

Breed.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	All Months.
Friesians	3·57	3·56	3·51	3·58	3·51	3·55	3·59	3·46	3·58	3·48	3·68	3·53	3·55
Milking Shorthorns	3·99	3·97	3·98	3·96	4·12	4·86	3·65	4·49	3·53	4·37	3·79	4·06	3·99
Ayrshires	4·14	4·19	4·03	4·06	4·49	3·98	3·42	3·90	..	4·47	3·96	4·11	4·12
Jerseys	5·65	5·72	5·68	5·50	5·43	5·67	5·83	5·64	..	..	4·99	5·80	5·66
Mean tests of four breeds..	4·34	4·36	4·30	4·28	4·39	4·52	4·12	4·37	..	..	4·11	4·38	4·33

Table 17.—Variation in Tests of the Principal Breeds for Different Months of the Year.

(The monthly tests are computed irrespective of the time of commencement of the lactation period.)

Breed.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	All Months.*
Friesians	3·82	3·63	3·48	3·46	3·45	3·47	3·50	3·60	3·70	3·79	3·88	3·90	3·63
Milking Shorthorns	4·36	3·87	3·73	3·79	3·87	3·93	4·03	4·19	4·35	4·43	4·61	4·62	4·13
Ayrshires	4·43	4·18	3·93	4·00	4·05	4·12	4·10	4·17	4·33	4·42	4·53	4·53	4·23
Red Polls	5·08	4·43	4·07	4·17	4·17	4·20	4·24	4·46	4·60	4·85	5·08	5·10	4·54
Jerseys	5·86	5·15	5·15	5·37	5·54	5·66	5·71	5·94	6·38	6·53	6·59	6·49	5·85
Mean	4·71	4·25	4·07	4·16	4·22	4·28	4·32	4·47	4·67	4·80	4·94	4·93	4·48

* The tests vary from those for a similar column in Table 16 for the reason that these tests are calculated irrespective of milk-production, while for the other table they are computed by the method outlined at the opening of this article.

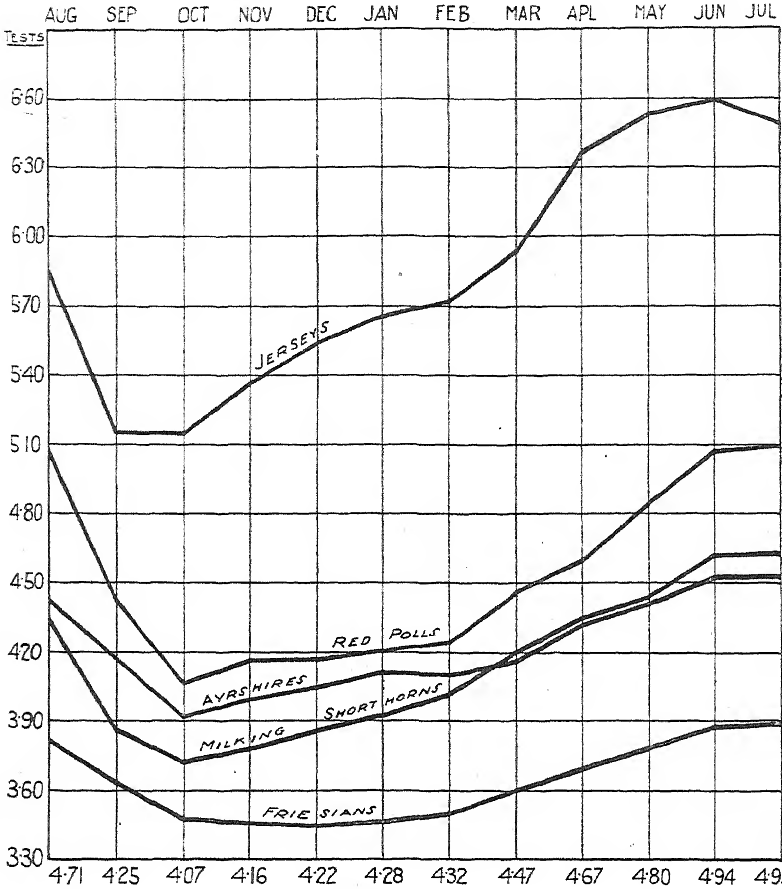
all months of commencement, which reads 4·33 per cent. The average for all breeds, grouping December, January, February, March, and June together, is 0·03 below the average for all months.

The table is rather incomplete to be sufficiently reliable, so the question may be attacked from another angle. In order to obtain an indication of the months of the year during which cows test highest, lactational tests for the chief breeds have been summated and averaged for all months of the year. In other words, this analysis gives the average test for any particular month according to the breed of cow, and irrespective of the month of commencement of test. The results are presented in Graph 11. A glance at this graph suffices to show that the variation in tests for different months is marked. The tests for June and July rank highest in each case, May and August coming next. October is the lowest in each curve with the exception of the Friesians, in which case the lowest point occurs for the month of December. September, October, and November are bound to be low, for the reason that grass feed is then at its best and most abundant. This keeps the quantity of milk-production up with the subsequent loss in test. This point is readily apparent in cases where cows are completing a lactation period in the spring (see August to December curves in Graph 7 of third article of series). The curves of the five breeds vary somewhat in conformation. However, the average figures of the five breeds given at the foot of the graph (No. 11) present the general position very clearly. All cows were not tested the full number of times, which may be either twelve or thirteen, and for this reason equal numbers are not represented for each month. In order to ascertain how this affected the results a number of Friesian records were selected, for each of which the annual test was approximately 3·55 per cent. (this being the average annual test for all Friesians), and for each there were twelve monthly tests. Six were selected for each month of commencement, and thus seventy-two records altogether are presented.

The result is given in Graph 12. The curve for all Friesians is included for purposes of comparison. The figures at the top and bottom of the graph refer respectively to the curves for the "selected Friesians" and for "all Friesians." The selected Friesians give a curve considerably flattened out compared with that for all Friesians. The general trend, however, remains practically the same, and the curve lends itself to the same division which is characteristic of the other.

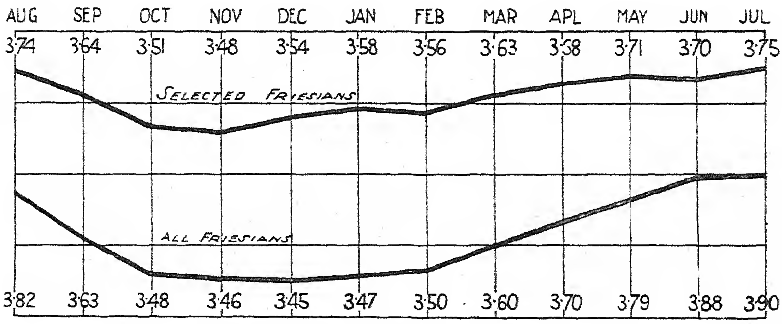
The grouping of the results into periods is given in Table 18. For the selected Friesians the range of variation over the three groups has been considerably reduced from that for all Friesians, the reduction amounting to 100 per cent. It is very probable that equal reductions in the range of variation would be found in the results of standard data for the other breeds. At the same time it is expected that the trend of the curves as shown in Graph 11 would be confirmed. By adopting for each breed in Graph 11 similar groupings to those of Table 18, one is better able to understand the results given in Tables 15 and 16.

The groupings are not necessarily the same for each breed, and to facilitate this the figures for Graph 11 are given in Table 17. Flush



GRAPH 11. VARIATION IN TESTS OF THE PRINCIPAL BREEDS FOR DIFFERENT MONTHS OF THE YEAR.

(In this and the next graph the monthly tests are computed irrespective of the time of commencement of the lactation period.)



GRAPH 12. VARIATION IN FRIESIAN TESTS FOR DIFFERENT MONTHS OF THE YEAR. STANDARD VERSUS COMPLETE DATA.

of milk-production varies somewhat with the breed, the general rule being that the heavier the breed the later the time. Thus Jersey cows, because they are lighter, reach flush of milk-production after calving earlier than cows of the other principal dairy breeds. Furthermore, the lactational tests for Jerseys rise continually throughout the lactation period, this, as pointed out in the third article, not being the case for the other breeds (see Graph 4, page 78, *Journal*, February, 1925). For the other breeds the test decreases for a while and then rises steadily to the end. Lactational-test curves vary for different periods of the year of commencement, and so does flush of milk-production. As a rule flush of milk-production is fairly well maintained for cows of good dairy qualities until about the sixth month. If these points are considered in conjunction with Table 17 one now sees the reason for the apparent anomalous result for the Jerseys in Table 15.

To sum up, therefore, May, June, July, and August are the highest-testing months. Cows commencing so that they reach the flush of their milk-production during the above-mentioned period will have higher annual tests, and will produce more butterfat, than for any other period of commencement. This conclusion agrees with that of an investigation made by the United States Dairy Division (see U.S.A. Bulletin 1071), in which it was found that autumn-freshened cows produced most butterfat, next in order being winter calvers, and spring and summer calvers lowest with equal amounts. In all 10,870 records were studied.

Table 18.—Friesian Monthly Tests for Different Periods of the Year, irrespective of Time of Commencement of Lactation Period: Standard versus *Complete Data.*

Periods.	All Friesians.		Selected Friesians.	
	Average Test.	Percentage Total Range of Variation over Three Periods.	Average Test.	Percentage Total Range of Variation over Three Periods.
May, June, July, August ..	3·85	..	3·72	..
March, April, September ..	3·64	10·5	3·65	5·2
October, November, December, January, February	3·47	..	3·53	..
Average monthly test ..	3·63	..	3·63	..

NOTE.—For individual monthly tests see Graph 12.

YEARLY VARIATIONS DUE TO LENGTH OF PERIOD OF GESTATION DURING TEST.

In order to ascertain the effect of the length of the period of gestation on the annual test a random selection of available data has been taken and tabulated according to the varying periods between commencement and effective service during test. The results of this analysis are given in Table 19. Where cows are empty for less than eighty-three days during test they will calve within 365 days following calving at commencement (the gestation period is taken as 282 days). Such records are represented by the first groups given in the table.

The other groups taken in order are for cows calving subsequent to test during the thirteenth, fourteenth, and fifteenth months respectively. The variations in test for this table are of a peculiar nature, and require further investigation. However, it appears clear that cows test highest for a period of about thirteen and a half months between consecutive calvings. If the period is more than this the annual test is lowered somewhat. The two- and four-year-old Friesians do not agree very well in variations for similar groups, but by combining the data the average tests for the groups reading downwards in the table are then 3·50, 3·46, 3·52, and 3·51, and thus agree closely with the Jersey results.

Table 19.—Variations in Annual Tests due to Length of Period of Gestation during Test.

Number of Days empty after Commencement of Test, both Limits inclusive.	Two-year-old Jerseys for Seasons 1914–15 and 1915–16.		Two-year-old Friesians for Seasons 1914–15 and 1915–16.		12,000 lb., 13,000 lb., and 14,000 lb. Milk-records of the Four-year-old Friesians for all Seasons.	
	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.	Average Annual Test.	Number of Records.
Up to 85 ..	5·54	26	3·58	11	3·43	13
86–115	5·52	33	3·46	12	3·47	10
116–145	6·01	25	3·56	19	3·49	21
146–183	5·47	11	3·59	8	3·46	11
Average tests for all groups	5·65	95	3·55	50	3·46	55

Table 20.—Variation in Annual Tests due to Length of Lactation Period: Jersey Data.

Length of Lactation Period in Days.	Average Annual Test.	Number of Records.
Up to 325	5·59	24
326–355	5·52	15
356–365	5·47	20

By selecting Jersey two-year-olds data from the previous tabulation for which shorter periods than 116 days occurred between calving at commencement and effective service during test, and grouping these records according to the varying number of days in milk, test variations were obtained as shown in Table 20. The results show that the shorter the lactation period the higher is the annual test.* The twenty records for the limits 356–365 days as given in this table were grouped into two, according as the "fallow" period was more or less than ninety-five days. The average annual test for the shorter period was 5·52, and that for the longer period 5·45. Thus after eliminating the factor of length of lactation period it is still found that the factor of length of pregnancy causes variations in the annual test.

* This is not necessarily true in cases where the lactation period is terminated before a cow is actually dry, as is the case for some C.O.R. records. Also in many C.O.R. records for which cows have milked the full allowed lactation period (365 days) the cows are far from being dry.

Referring back to Table 19, it is now seen that for the group "up to 85 days" two factors are operating which tend to raise the test, whereas for the remaining groups there is only one. This perhaps explains the dip in the annual tests occurring between the first and third groups. The intermediate tests for the two-year-old Jerseys from 116 to 183 days for limits of ten days only are as follows: 6·09, 6·06, 5·68, 5·67, 5·45, 5·12. Therefore it can be concluded that, with the exception of the high point indicated in the third group of Table 10, the shorter the fallow period during test the higher is the annual test, and the longer that period the lower the test, the latter being true up to a period of about seven and a half months, when no further lowering of tests takes place. This statement is well borne out in Graph 9, page 86, and text, page 87, *Journal*, February last.

YEARLY VARIATIONS DUE TO NATURE OF SEASON.

Variations in annual test due to the nature of the season, though very small, are nevertheless quite interesting. In Table 21 the averages for the Friesian tests, amount of rainfall, and number of rainy days are given season by season. Plus and minus variations are supplied in the adjoining columns for each of the three mentioned items, and for purposes of comparison the mean figures for the eleven seasons are given at the foot of the table. The average tests are estimated equivalent to maturity—that is, for each season the average milk and butterfat figures for the various classes according to age have been raised to what they would be if the records had been made at maturity, and the test obtained from this result. By this means the factor of age is eliminated from the results.

Correlation between amount of rainfall and yearly test variations seems difficult at first, as the table shows tests for six seasons varying inversely with the rainfall, while for the five remaining the relation is direct. However, when both amount of rainfall and number of rainy days are considered with the test variations, one is able to elucidate some of the difficulties. The variations in the first and third right-hand columns agree in sign for each season with but three exceptions—1912–13, 1916–17, and 1919–20. For 1912–13 the South Island was above and the North Island below the mean rainfall, while for season 1916–17 the contrary was the case. In 1919–20, however, the amount of rainfall for each Island was above and the number of rainy days below the mean for all seasons. In the light of this information it is not unreasonable to accept 1912–13 as conforming very closely to a season of average rainfall. The position is strengthened also in regard to season 1916–17. The number of rainy days for season 1919–20 is so much below the average that this season can be safely classed as a poor one for rainfall in general.

Now that the positions in regard to these seasons have been somewhat reconciled, there are left only three other seasons (marked with an asterisk) where the test variations vary directly with the rainfall. When it is borne in mind that the percentage of cows tested in each Island varies from season to season, that the testing season somewhat overlaps twelve months, that the amount of testing is not represented equally or in all districts where rainfall-recording stations

are situated, and that the climate varies considerably throughout New Zealand, it is not at all surprising that a few of the results do not conform to the general rule. There appears, however, to be sufficient evidence to conclude that the small fluctuations which occur in the test from season to season are due to the rainfall and vary inversely with it, and that, with regard to rainfall, both amount of rainfall and number of rainy days must be given due consideration.

Table 21.—Variation in Annual Tests due to Nature of Season experienced. Total Friesian Data.

Season.	Average Mature Equivalent Test.	Variations from Mean Mature Equivalent Test.	Average Seasonal Rainfall for New Zealand.	Variations from Mean Seasonal Rainfall for New Zealand.	Average Number of Rainy Days per Season for New Zealand.	Variations from Mean Number of Rainy Days per Season for New Zealand.
			Inches.	Inches.		
1912–13 ..	3·52	0·00	42·35	− 1·20	155·0	+ 4·9
1913–14 ..	3·51	−0·01	45·09	+ 1·54	165·2	+15·1
1914–15 ..	3·56	+0·04	32·92	−10·63	133·2	−16·9
1915–16* ..	3·49	−0·03	41·08	− 2·47	142·9	− 7·2
1916–17 ..	3·51	−0·01	48·54	+ 4·99	149·5	− 0·6
1917–18* ..	3·58	+0·06	49·02	+ 5·47	161·4	+11·3
1918–19* ..	3·51	−0·01	39·52	− 4·03	144·9	− 5·2
1919–20 ..	3·59	+0·07	45·39	+ 1·84	140·6	− 9·5
1920–21 ..	3·55	+0·03	38·75	− 4·80	139·5	−10·6
1921–22 ..	3·45	−0·07	46·76	+ 3·21	154·2	+ 4·1
1922–23 ..	3·48	−0·04	49·67	+ 6·12	164·6	+14·5
Mean ..	3·52	±0·03	43·55	± 4·21	150·1	± 9·1

* Exceptions.

YEARLY VARIATIONS DUE TO CONDITION OF COW, FEEDING, ETC.

As mentioned in the two preceding articles, there are no data available from certificate-of-record testing with which to investigate for the effect of variations due to condition, feeding, &c., of the cow. It is considered that cows of approved dairy type commencing in good condition, and so maintained during test, would test higher than cows which commenced in poor condition or were poorly fed during the lactation period.

YEARLY VARIATIONS DUE TO AGE.

As the age advances after first calving, the annual test gradually decreases by small amounts for approximately ten lactation periods. About this stage it commences to rise slightly. Tests for the Jerseys and Friesians according to age are set out in Table 22. Figures for the Ayrshires and Milking Shorthorns are not included, for the reason that they were rather irregular, due to the numbers of records representing many of the ages being very few. The percentage total range of variation for the four breeds according to the grouping in the table is about 6 per cent. only, the respective percentages for the Jerseys and Friesians reading 5·8 and 3·7.

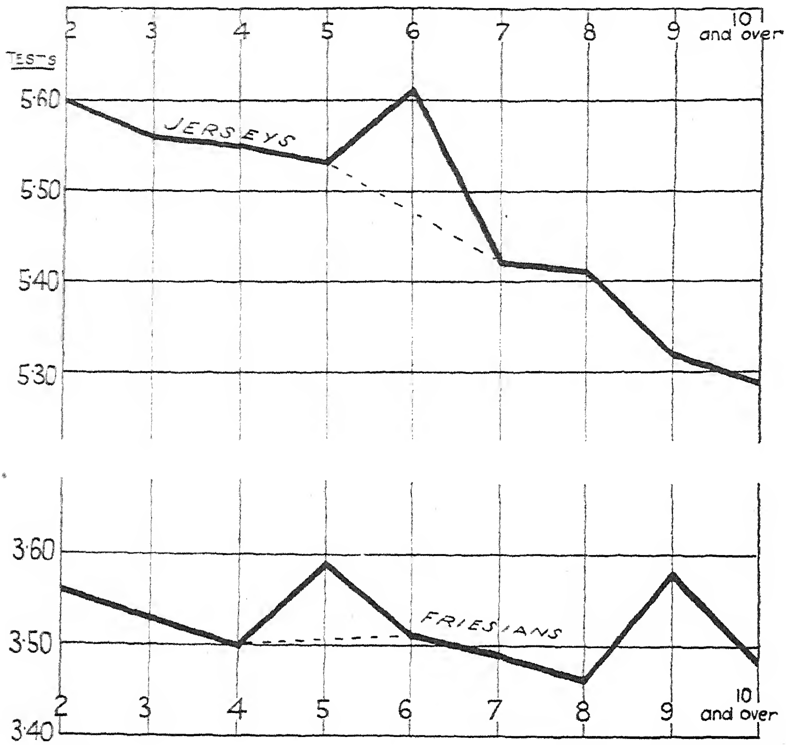
The trend of variation in test for the factor of age is more clearly seen in Graph 13, which represents the results given in Table 22. The most striking feature in these two curves occurs at the age of five years for the Friesians and at six years for the Jerseys. At these points the practically uniform trend of the curves is considerably upset. These points seem quite unaccountable, but if they are omitted and the blanks bridged by the dotted lines shown in the graph it is found that the trend of the curves is quite uniform.

The abnormal point varies slightly with the breed, the ages at which it occurs for the chief New Zealand breeds being as follows: Jersey, six years; Friesian, five years; Ayrshire and Milking Shorthorn, seven years. These abnormal points are all high ones, but when United States and New Zealand Jersey tests are compared for the factor of age, as given in Table 23, quite an astonishing position is revealed. The abnormal point for the American Jerseys occurs, as in the case of the New Zealand Jerseys, at the age of six years, but for some unknown reason it is abnormally low. In the right-hand column of the table the mean of the two results is given. The abnormal point has been absorbed, showing that in the one case it was as high as it was low in the other. Unfortunately, the writer has no American data except for the Jersey breed. It would be interesting to see if the abnormal points for the other breeds of the United States were all low ones. One important point, however, is that in all cases the abnormal point is practically coincident with maximum butterfat-production, occurring if anything just before this stage. The ages of maximum production and maturity would be expected to coincide, and thus it appears that the abnormal-test point depends on the reaching of maturity, and is due to a physiological change in the cow at this stage. The connection between the action and changes of metabolic activity and the quality of milk and its variations is not very well understood, but there seems good reason to believe that this factor is quite an important one.

Table 22.—Variations in Annual Tests due to Age.

Age.	Jerseys.		Friesians.	
	Average Test.	Number of Records.	Average Test.	Number of Records.
Years.				
Two	5·60	1,154	3·56	413
Three ..	5·56	407	3·53	213
Four	5·55	250	3·50	137
Five	5·53	178	3·59*	79
Six	5·61*	152	3·51	66
Seven ..	5·42	99	3·49	55
Eight.. ..	5·41	54	3·46	26
Nine	5·32	51	3·58	12
Ten and over ..	5·29	46	3·48	41
Average tests for all ages	5·55	2,391	3·54	1,042

* Abnormal points.



GRAPH 13. VARIATION IN ANNUAL TESTS DUE TO AGE.

(The test for the nine-year-old Friesians is anomalous, and is due no doubt to the paucity of records for this group. See Table 22.)

Table 23.—Variations in Annual Test due to Age: United States and New Zealand Jersey Tests compared.

Age.	Average Tests of U.S.A. Jerseys.	Average Tests of N.Z. Jerseys.	Mean of the Two.
Yearlings	5·43		
Two years	5·45	5·60	5·52
Three years	5·41	5·56	5·49
Four years	5·41	5·55	5·48
Five years	5·30	5·53	5·42
Six years	5·21*	5·61*	5·41
Seven years	5·28	5·42	5·35
Eight years	5·25	5·41	5·33
Nine years	5·23	5·32	5·28
Ten years	5·22	5·28	5·25
Eleven years ..	5·17	5·39	5·28

* Abnormal points.

YEARLY VARIATIONS DUE TO QUANTITY IN MILK-PRODUCTION.

This phase of yearly variations was treated in the first article of this series (September, 1924), wherein it was stated that quantity and quality of milk-production were believed to be separately inheritable, but that the two had a limited interdependence and varied inversely, this being most noticeable when one factor varied considerably in either extreme.

CONCLUSIONS.

Summing up the general position in regard to variations in yearly tests, it is found that in all cases, except for the factor of breed, the variations are of small magnitude. Furthermore, they depend almost entirely on monthly test variations, and if the results of this article are studied in conjunction with those of the previous one a better grip of the subject should be obtained.

NOTES.

Period of Data.—The Jersey data used in the compilation of Tables 15, 16, and 17, and Graph 11, are for season 1918–19 only. In all other cases, unless otherwise stated, the data used for the various breeds comprise all first-class records from the commencement of C.O.R. testing (1913) up to 31st December, 1923.

Corrections.—In the third article of this series—*Journal*, February, 1925—(1) the footnote marked * on page 77 should read, "The equation for this line is: Number of days in the dip of the lactational-test curve of a particular breed = 722 – (163 times the average test of that breed)"; (2) under the heading of "Lactational Variations due to Nature of Season," 1915–16 should be deleted from the list of good seasons.

(Series to be concluded.)

SOME SOUTH AFRICAN AGRICULTURAL NOTES.

M. H. DIXON, A.C.P., Technical College, Napier.

TEFF-GRASS.

ON a recent visit to South Africa the writer found that the Abyssinian grass named teff (*Eragrostis Abyssinicus*) is steadily gaining favour as a secondary crop. Many farmers in the Transvaal declared that they intended it to become their main fodder in the future, finding it less wasteful than lucerne and just as well liked by their stock. An analysis of teff recently published by the South African Department of Agriculture compared very favourably with that of lucerne.

After obtaining a fine tilth, from 4 lb. to 5 lb. only of seed per acre is sown, and, if no rain occurs in the interval between harrowing and sowing, the seed is not harrowed in. If, on the other hand, the land has had rain during this interval, the ground is reharrowed with a light harrow or similar cultivator after the seed has been sown. Growth at first is very slow, but after four weeks' favourable weather the field begins to show green, and from this stage onwards the growth is very rapid, and the teff is usually ready to cut four months from time of germination. Given favourable weather conditions, a profitable second cut can be made in two months after the first one. A good crop yields from 2 to 2½ tons per acre, and the market price of good quality teff hay runs from £4 to £4 10s. per ton.

Teff hay can be carried long distances over rough roads or paddocks without much loss, as its constituent parts are not in the least brittle. The South African farmer finds that lucerne hay, even when in bales, loses a good deal of the leaf-growth during transit from farm to town, or from one part to another on the larger farms. It is also found that there is a greater loss of the more nutritive parts of lucerne hay after it is distributed to the stock than is the case with teff.

Teff has a great popularity for cleaning dirty lands, and I was frequently told that when allowed to germinate at the same time as prevalent weeds, such as amaranthus (pig-weed or Prince of Wales feathers), which is as troublesome in the Transvaal as in some parts of New Zealand, it invariably smothers the weeds in addition to giving a profitable yield of hay.

[NOTE.—A test plot is being sown in teff-grass by Mr. Dixon at Napier this autumn, and he intends making another sowing in the spring. Certain previous trials under New Zealand conditions have not been altogether favourable to teff for this country, and caution is suggested until further local experience is acquired.—EDITOR.]

THE MAIZE INDUSTRY.

A feeling of greater security is being given to the South African maize-growers by the erection in several towns of concrete grain-elevators, which consist of a number of storage bins—usually about twenty-four—each having a capacity of 40 tons, and half-a-dozen storage cylinders having about three times this capacity. In January of this year a conference was held at Johannesburg, attended by representatives of the South African Agricultural Union, the South African Maize-growers' Association, and the Central Agricultural Co-operative Society, to consider the organization of the maize industry on co-operative lines more or less similar to those of the Alberta Wheat Producers' Co-operative Association in Canada.

AGRICULTURAL ECONOMICS.

The work of the South African Department of Agriculture has mainly been in the direction of combating plant and animal diseases, and in improving and promoting the increase of plant and animal products. This year, however, has seen the creation of the Division of Agricultural Economics and Markets, of which Dr. F. Geldenhuys, of Bloemfontein, has been appointed chief. The work of this division will include the investigation of all kinds of economic questions associated with farming, marketing of crops, co-operation, farm-management, &c. Such questions as farm credits, tenant systems, and the social welfare of the farming population will be investigated.

VETERINARY RESEARCH AND TRAINING.

The numerous diseases prevalent among horses, mules, cattle, goats, and sheep in South Africa have caused the establishment of research institutions for the investigation of these diseases. The largest of these was visited—Onderstepoort Biochemical Research College, near Pretoria, which has four departments, one being a university school for students who have previously spent two years in the study of English, mathematics, and general subjects at some other university college, and have transferred to Onderstepoort to specialize as veteri-

nary surgeons. The course extends over three years, and there are thirty students this year — ten for each year's course. The other departments are respectively for original research work, the preparation, testing, and distribution of vaccines (for which purpose many kinds of animals are kept on the place), and the administration department. The vaccines for anthrax, redwater, gall-sickness, bluetongue, and black-quarter (blackleg) were shown, also a powder which has been proved to be a very effective remedy for wire-worms in sheep. After seeing many features of the microscopic work carried out in the different laboratories and also numbers of the animals on which new vaccines were being tested, I was not surprised when told by Dr. E. V. Cowdray, of the Rockefeller Research Institute, New York, who had been engaged in research work for six months at Onderstepoort, that he did not think there was any college, even in America, which was doing greater service for the farming community of the country. Large quantities of the vaccines and powders are despatched every week for distribution to farmers at very small cost, each remedy being accompanied by printed matter giving very complete instructions and advice as to treatment.

MANURIAL EXPERIMENTS.

A visit to the Government Experimental Farm and School of Agriculture in the Transvaal revealed that institution to be somewhat like a combination of our Ruakura Farm of Instruction and Lincoln College. Mr. Thomas D. Hall, of the Experimental Division, showed me results of fertilizer experiments on maize, teff, and potatoes. The general conclusions drawn from these were that, although light applications of some nitrogenous fertilizer are occasionally beneficial in the early stages of growth, the phosphatic constituent of any mixture of fertilizers is the only one that pays with certainty, and that in almost every experiment the application of superphosphate, 300 lb. to the acre, without any other fertilizer, had produced the best results. The success of this fertilizer was especially noticeable in the potato crops, the size and cooking-qualities of the potatoes from the plot receiving superphosphate at the rate mentioned being the best. Moreover, the value of superphosphate was apparent on crops of maize and clovers not treated with fertilizers that year, but where other crops on the same ground had received an application in the preceding season. Indeed, growth on those plots where superphosphate had been applied for the previous crop was better than on any of the others.

CLOSE SETTLEMENT.

Close settlement is being developed in the Transvaal by the sale of Government sections of from 50 to 80 acres situated along the bank of a river, each owner of a section having grazing-rights on the "common land," situated adjacent to the sections at a farther distance from the stream. A visit was paid to one of these settlements near the Mooi River, and also to a similar settlement in the Potchefstroom district, provided with water by means of irrigation canals leading away from the Klipdrift Dam, built by the Government at a cost of £80,000, each canal being five miles long. There are eighty families located at this particular settlement.

SEASONAL NOTES.

THE FARM.

CULTURAL OPERATIONS.

PLANS should be made at this period for next season's cropping-operations, and land required for spring sowing turned over. Where old pastures are to be broken up, skim ploughing in the autumn or early winter, followed by disking, especially on the heavier soils, as a preparation for the deeper spring ploughing, is a good insurance against dry summer conditions, besides allowing the natural elements — frost, air, and sunshine — to ameliorate the soil and make fresh plant-food available.

The relatively dry autumn experienced in several districts this season has had the effect of reducing to a great extent the usual autumn growth of pastures. This has there caused an earlier and more extensive feeding of roots and other forages, which in many cases may involve a shortage in early spring. A June sowing of Algerian oats, combined (on the heavier soils) with winter vetches, will help to fill any such deficiency.

AUXILIARY FEEDING OF DAIRY STOCK.

Wherever it can be managed great saving results from pulling and feeding out roots in clean paddocks, rather than turning the stock on to the crop, and a much smaller quantity of roots is required. Experiments go to prove that 60 lb. of roots per day fed to a cow in conjunction with good hay gives very much better results than where the cow is allowed to eat as much as she can. In the latter case the animal may eat 1 cwt. or more, and her system is not able to deal with the material satisfactorily. The ideal ration is a medium quantity of good material rather than large quantities which the animal cannot digest. Great care should also be taken to see that stock eating roots have a liberal supply of good hay or a run-off on pasture with plenty of roughage.

The present is a good period for pulling the mangold crop, so as to give the roots ample time to mature before being fed. Such time should be at least one month, but two is much better. A mangold is not in proper condition to feed out in quantity until soft enough to allow a pocket-knife to be stuck into it easily and drawn out again without lifting the root. A great many may have to be fed before reaching this condition, but full maturity is the condition to aim at. When starting cows on mangolds they should be fed lightly for a few days, commencing with 15 lb. to 20 lb. per day and increasing at the end of a week to 40 lb. or 50 lb., which should be the maximum for a day. In the milder localities the roots may be pulled and left in the field to ripen, but when there is danger of heavy frosts or the land is required for further cropping it is best to cart them off and store in a dry, warm, situation, according to the methods described last month.

Carrot crops will still be making some growth, but may now be fed at any time. These roots are best pulled and fed straight out from the field.

Where ensilage is available, cows that have not been used to this fodder should get a small quantity—say, 5 lb. to 10 lb. per head per day—for the first few days, increasing up to a maximum of 40 lb. per day. Silage should be fed fresh each day and, as far as possible, straight from the stack to the stock. If exposed to the weather, deterioration is fairly rapid.

The value of concentrates for dairy cows—especially where winter milking is practised—is being increasingly recognized as our dairying becomes more intensified.

PASTURE-MANAGEMENT.

The formation and maintenance of a pasture does not end with the selection of the seed-mixture and annual top-dressing. Subdivision, spelling, stocking, and cultivation have a far-reaching effect on the quantity and quality of herbage produced. Under the head of cultivation can be included mowing, rolling, harrowing, disking, &c. The mower is valuable for disposing of any rank growth neglected by the stock and allowing fresh growth to come away, particularly in fields grazed by cattle. Except for hay, it is a mistake ever to allow the grass to stand more than 5 in. or 6 in. high. Rolling is an operation seldom carried out, but does much good on light land, more particularly where a severe winter is experienced. It strengthens any grasses or clovers that have been lifted by frost or loosened by stock. Rolling, however, should never be done during frost or when the land is abnormally wet.

Harrowing is one of the cheapest and most profitable operations on the farm, and there are few better ways of utilizing days when other work cannot be undertaken. Stock manure is a fine top-dressing, and its distribution by harrowing is a factor in the maintenance of a good turf. Chain-harrows will do this work well, but when the tripods are employed further benefits are derived from the cultivation of the turf, whereby moss and dead matter are removed and the grass-roots stimulated. In some cases, such as that of a sod-bound turf, a good disking, followed by rolling, will put new vigour into the pasture.

The subject of top-dressing with artificial fertilizers was dealt with at some length in last month's notes, but a reminder may be given that June is one of the best months for this operation. A few farmers appear to be afraid to apply phosphates in the winter, having an idea that they will disappear in the drainage-water before spring. There is no reason for such fears; it has been clearly proved that leaching of phosphates need not be seriously considered.

GENERAL.

Any necessary repairs to cow-sheds, yards, &c., should be pushed on, especially where concrete floors are being put down. If these floors are allowed to harden properly before being used the uneven pot-hole surface so frequently seen is obviated. Bog-holes and bad crossings should have attention, as these frequently cause considerable loss in the spring when stock are weak. Arrears in drainage-work should also be attended to. Where the mouths of drains are consistently kept open full benefit of the drainage-system will be secured.

—*Fields Division.*

THE ORCHARD.

CLEANING-UP.

THE picking season now being over, the orchardist will be able to devote his attention to other seasonable work, and also to give the orchard, packing-shed, and surroundings a general clean-up. An important preliminary is the cleaning-up of all fruit unfit for sale. It is bad practice to allow half-decayed and rotten fruit to lie about either under the trees or around the packing-shed. This class of fruit is usually infected, or is liable to breed fungoid diseases which become harmful to both trees and fruit.

PRUNING.

This work will commence in real earnest in June. All stone-fruits will have lost their leaves, and they should be the first to receive attention. Many different methods are adopted in pruning stone-fruits—some good, some indifferent. It is not possible to lay down any rule that will be applicable to all parts of the Dominion, but the foundation principles advocated by the Department from time to time still hold good. It is in detail that several different methods can be followed with satisfactory results. Some of the leading growers in America are carrying out very little pruning on stone-fruits, but it is quite an easy matter to go from one extreme to the other. While not being an advocate of non-pruning in this Dominion, I consider it bad practice to cut too severely. One should always be guided by local conditions, and, moreover, test several systems in order to ascertain the relative value of each.

The commonest mistake—and a very harmful one—is to prune trees hastily on a uniform method, which, however good it may be in itself, cannot but be harmful to a large proportion of the orchard. For example, the Sturmer, Delicious, and Jonathan apple-trees are of such diverse type that a one-system practice must do harm. The simplest way is to take one variety at a time, to remember its nature, and do all that is possible to correct its natural bias where such is necessary. The Delicious tree is usually very vigorous and inclined to become densely wooded, and to cut the leaders hard and stop the laterals back to young wood-buds would only intensify its habits, which are bad from a fruitgrower's point of view. On a mature tree the leaders should be pruned lightly, if at all, and the laterals well thinned out, cutting them clean back to the leader from which they originate. If it is necessary to shorten remaining laterals, care should be taken to cut to fruit-buds or small side twigs, thus stimulating as little growth as possible. This method has been found to check growth and encourage cropping. The Sturmer in most fruitgrowing districts is a type of those with just the opposite characteristics, and the pruner has usually to prune the tree, which is naturally a heavy cropper, to encourage a vigorous constitution. He has to cut the leaders harder than in the case of the Delicious, and, where laterals are inclined to fail, to cut them to young wood-buds so as to invigorate them. If the pruner studies his pip-fruit trees along these lines a great improvement will be brought about in many orchards.

MISCELLANEOUS.

When pruning, the opportunity should be taken of examining the trees carefully for disease, and any requiring special treatment can be flagged with a piece of cotton cloth carried for the purpose.

The best-cropping trees are usually well known—indeed, they are often the centre of considerable admiration. Suitable wood cut from such trees should be saved for any reworking that has to be done, carefully labelled, and heeled in damp, sandy ground in a cool place.

The preparation of land for further planting may be proceeded with; but so important is this preliminary work that if it cannot be completed satisfactorily planting should be deferred for this season.

If fruit is sound and properly stacked in a good, well-ventilated shed there should be little loss from decay, but it is always well to keep acquainted with the condition of stocks. Do not fail to market varieties at the right season. Heavy losses are incurred annually by overstoring. Do not be tempted to store cull fruit or market it either; it is not wanted, and is much better fed to stock.

—*L. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

To control *Lecanium Oleæ* scale an application may now be made of either red oil, 1–40, or commercial lime-sulphur, 1–35, without fear of defoliation. Where there is doubt as to the condition of the tree being suitable to stand an application of the compound necessary, growers will have to take a certain amount of risk of defoliation, as if the spray is not applied very shortly the scales will have become sufficiently matured to withstand the spraying to a considerable extent, and a maximum kill will not be obtained.

Measures for control of brown-rot on citrus-fruits should now be put in hand. Precautions which would appear to be most important are: Firstly, to remove all bottom branches from the trees, so as to leave none that will hang any nearer than 18 in. from the ground. Secondly, to keep all matured fruits picked periodically. Thirdly, to keep the centre of the trees as open as possible, so as to allow free ventilation. Further, in cases where infection occurred last year the grower is advised to spray the soil beneath the tree, as far out as the spread of the branches, with pure bluestone, 1–15, giving a liberal dressing. It must be explained that the spores of brown-rot are motile, and travel chiefly by means of a thin film of water—infection taking place firstly from spores in the ground. By this means the source of infection through the branches sweeping on the ground and thus picking up the infection, or by heavy rains splashing the spores to the low-hanging branches, will be considerably lessened. Further, there is little doubt that the spores may travel up the trunk during very wet weather when the tree is saturated with water over a considerable period. Spraying of the trees with bordeaux, 4–4–40, at the latter part of May, as a preventive, may, of course, be resorted to, but the adoption of the method outlined will tend to get right at the source of the trouble and kill the spores themselves in the ground before maturity.

The soil is now in excellent condition generally for putting in hand the work of preparation of new citrus-orchard sites. Those growers who are intending to plant should place their orders as early as possible with reliable nurserymen.

STRAWBERRY-GROWING.

Generally, growers are well forward with the preparation of sites for the new beds. Those who have so far not made the necessary arrangements for the supply of a reliable strain of Marguerite, Duke of Edinburgh, or Melba, are recommended to make early application, as it is anticipated that there will be a heavy demand next season. The variety Captain Cook was grown last season in fair quantities, and the fruit, though not surpassing the Marguerite in quality, carried in chips equally well, and generally opened up in a showy condition. In many localities the plant does as well as the Marguerite, but complaints have been received from some growers that it lacks constitution as compared with the latter variety.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

SELECTION OF BREEDING-STOCK.

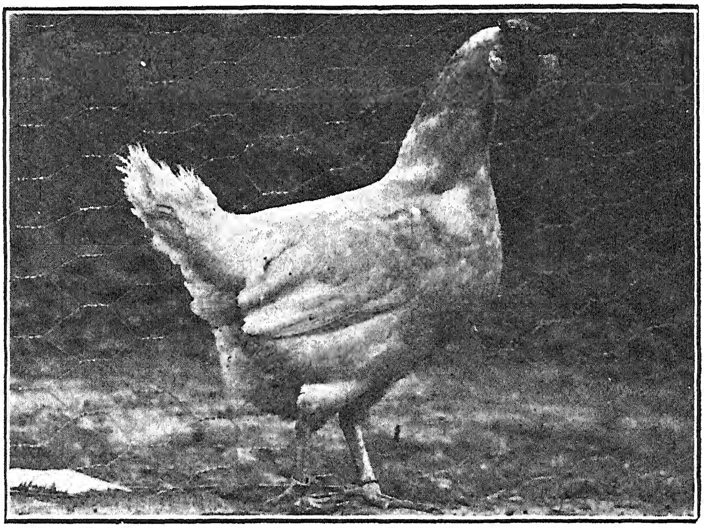
THE coming month should see all the breeding-pens mated up. There is yet ample time to commence hatching operations, but it is always a wise course to have the birds mated well ahead, in order that they may be well settled down before the eggs are required for reproductive purposes. A common mistake made, especially by side-line poultry-keepers, is to use eggs for hatching purposes indiscriminately from a flock of fowls. If a good laying-strain is to be built up or maintained it is of the first importance that only the best birds in the flock shall be bred from. These should be placed in a breeding-pen by themselves. The great underlying principle in all breeding is that like produces like. Thus, if the best returns are to be secured and cull stock reduced to a minimum, nothing but ideal specimens should be bred from.

On all well-managed plants (as advised in previous notes) the proposed breeders for the coming season should have been chosen and carefully marked before the commencement of the moulting-period, for it is then and only then that the best specimens can be selected with any degree of certainty. For a bird to give a heavy egg-yield and be a long-season layer she must necessarily be a late moulter, and it is difficult or almost impossible to detect such birds if left till the whole flock has moulted. Where individual records have been kept by means of trap-nests or single pens the birds can be mated according to their productive capacity, as the individual record is the only means of knowing accurately the laying-power of a bird. This system of finding the best layer, however, is seldom adopted by other than specialist breeders. Thus if nothing is known of the laying-power of a bird she must necessarily be selected by her general appearance, and there is no better guide to this than by choosing the late moulter—providing, of course, that the bird possesses desirable breeding characters in other respects.

The eye for form is to some extent a natural gift, but with careful study and observation the average poultry-keeper will find little difficulty in selecting the most suitable birds. In the first place, it is important to have fixed types of purebred birds, or at

least of birds that are fair specimens of the breed they represent. It is true that crossbred fowls which have no special type or points indicative of purity of breed will at times give a good egg-yield. There are exceptions to every rule, but this does not disprove that a definite type should be aimed at. The chief objection to breeding from a crossbred bird is that this invariably destroys fixity of type, and opens the door to reversion and the appearance of latent undesirable characteristics.

Having purebred stock, the next consideration should be given to constitutional vigour, as, no matter how good the type or pedigree of performance possessed, desirable progeny will not be produced if there is the slightest constitutional taint in the parent stock. Especially should the male be strong in points indicating



WHITE LEGHORN, LATE MOULTER, OF GOOD BREEDING-TYPE.

Photo taken towards end of a heavy-laying season, this accounting for general shabby appearance of bird.

stamina. The head affords a good guide in this respect. Generally a bird of either sex with a short broad head, a stout well-curved beak, bright clear prominent eyes, and face free from feathers and wrinkles has a good constitution. These points should be combined with a well-developed crop (indicating heart and lung capacity), tight feathering, short shanks set wide apart, and an active, alert, businesslike appearance. The shape of the hen denotes whether she is of a heavy-producing type or a meat-maker. The qualifications to be looked for in a good breeding-hen are indicated by an oblong body, well-developed crop, deep and full abdomen of fine texture, the bird thus tapering from thighs to head and forming a wedge-shaped appearance.

Care should also be taken to breed not only from birds which possess points indicative of purity of breed, laying-capacity, and undoubted constitutional vigour, but also from those laying a good marketable-sized egg—namely, 2 oz. or over in weight. In selecting a male to head the breeding-pen an endeavour should be made to have a bird with a maximum of constitutional points, and which is the son of a hen known to be a heavy layer of good-sized eggs. It is now generally conceded that the male bird is largely responsible in transmitting qualities for high egg-production. It is therefore well to make sure that he possesses a pedigree of performance in egg-laying.

It is not possible to say how many hens should be mated to one male, as this depends entirely on the vigour of the male and the amount of range available. On a free range good fertility of eggs may be obtained with one male to twenty or thirty hens, but the number of hens must be considerably reduced when the birds are under confined conditions. In the latter case six or eight of the heavy breeds and ten to twelve of the lighter breeds are sufficient for best results.

HOW TO FEED THE BREEDERS.

It will generally be found that better fertility of eggs and stronger chickens are produced from the feeding of grain to the breeders night and morning, mash food being eliminated from the ration. On no account should high egg-laying records be looked for in the breeding-pen. Thus meat, milk, or other forcing-foods should be fed with caution. At such a time birds cannot be over-supplied with green material, while crushed fresh sea-shell, gravel grit, and clean water should be within reach at all times. The aim should be to feed the birds well, while at the same time guarding them against storing up an excess of fat — a common cause of infertile eggs and the production of chickens that are difficult to rear. Having this in view, plenty of exercise is essential. Where a free range is not provided, exercise can be best induced by feeding the grain ration in deep litter in the house, whereby the birds are compelled to scratch for it.

The male should be examined frequently in order to ascertain if vermin are present. If these are found a good dusting with insect-powder will have the desired effect. Where it is found that he is not in a good breeding condition he should be taken out of the pen daily and given a good nourishing meal by himself. Very often a male is too attentive to the hens and allows them to get the bulk of the food, resulting in a rapid loss of condition in himself. An extra meal, as suggested, will do much to correct matters in this respect.

PERIOD FOR HATCHING.

For the main flock it will generally be found that from the middle of July to the end of August is the best time to have chickens of the heavier breeds hatched out, and for the lighter breeds from the middle of August to the end of September. It should be always remembered that it pays best to have the chickens hatched on the early side rather than on the late side. Besides

being more difficult to rear, the late-hatched chickens seldom grow to a desired size, and as a rule lay smaller eggs, and are always more susceptible to disease than birds hatched during the early season. The aim should be to have the chicks hatching out as the days commence to lengthen, so that they will be well developed before the hot trying summer weather sets in.

Of course, where early autumn eggs are desired the pullets must be chiefly depended upon to produce these, as at that time of the year the majority of the adult stock are commencing to take a rest prior to moulting. In such a case there is no objection to, but rather an advantage in, hatching out chickens of any breed, even White Leghorns, for the production of the high-priced autumn egg. Such stock will probably moult before the winter season sets in. The fact, however, of their producing a good supply of eggs when dear (at which time on the average plant there is much going out and little coming in) goes to show that there is more money to be made out of the early July-hatched pullets than the average poultry-keeper is aware of. Indeed, no plant can show a maximum of profit unless a good proportion of autumn and winter eggs is produced.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

WINTER PRECAUTIONS.

BEFORE the cold weather sets in every hive should be examined in order to make sure that the frames are completely covered with sufficient dry well-fitting mats to keep the bees protected. Wherever a damp or mouldy mat is discovered it should be replaced with a dry one, and the roof examined and repaired. No draughts should be allowed around the frames. Mats made of corn-sacks cut to the exact size of a zinc queen-excluder answer all requirements of warmth. Be sure they are placed in their exact position. If placed crookedly the edges are apt to be pushed out between the hive-body and the roof, and will in time absorb enough moisture to make them damp and unwholesome.

Once more the time approaches when the necessity for shelter should impress itself on the beekeeper. It is most essential that the bees be protected from cold winds during the winter. Should no permanent shelter be available, something temporary should be erected—if the bees are expected to prove in normal condition in the spring. Manuka scrub is excellent for making a temporary wind-break.

Weeds and grass should be kept down. A good clearing round the hives in autumn will suffice until spring, and will add materially to the comfort of the bees and the well-being of the hives. Not only should the entrances be cleared, but the ground all round the hives similarly treated, and the weeds raked up and destroyed.

CARE OF HIVES.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from

the ground to the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring that the hives have a free current of air beneath the bottom-boards and are thus more likely to keep dry. Never rest the bottom-boards on the ground, or they will rot in a very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

Apart from disease, there is no worse feature in an apiary than the presence of leaky hive-covers. A roof which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There will then be pollution unspeakable on the bottom-board, where the intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find more abnoxious than does their owner. There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should either cover them with zinc, ruberoid, or some other waterproof material. If economy must be practised he may cover with cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective waterproofing, and one which anybody can apply.

PLANS FOR NEXT SEASON.

During the off season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are crying out for room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and, while the bees are in a dormant condition, study the best methods of improving his stocks. Neither weather conditions, locality, nor any other factor will influence the honey crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

PROFITABLE HONEY PLANTS.

A new book entitled "Profitable Honey Plants of Australasia," by Tarlton Rayment, has been published by Messrs. Whitcombe and Tombs. This volume is very welcome, providing a useful guide to the many valuable nectar-secreting exotic and indigenous plants and weeds of Australia and New Zealand. The author is well known as a writer on apicultural matters, and his previous book, "Money in Bees," gave him a leading place among the authorities on the subject in Australia. The opening chapters of "Profitable Honey Plants," dealing with flower-structure, especially as they relate to the secretion of nectar, at once impress the reader with the fact that Mr. Rayment has closely studied the subject with particular reference to the bee as an economic factor in the fertilization of flowers. While the author does not profess to give a complete list of the honey plants of New Zealand, those that are mentioned — placed as they are in alphabetical order and designated by their common names — should prove a valuable source of reference to our beekeepers.

THE ANNUAL CONFERENCE.

A reminder may be given that the National Beekeepers' Association meets in conference at Greymouth on the 3rd, 4th, and 5th June. It is expected that beekeepers from all parts of the Dominion will attend. Lectures and demonstrations by leading commercial beekeepers will be given. Apart from the business of the conference, the officers of the local branch are arranging an excursion to view some of the scenic features of Westland.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

SOIL-TREATMENT.

THE effects on the land of continuous cropping of one kind was well known to our forefathers. The bad results were overcome by laying the land down in grass and clover for a period, and thus allowing it to recuperate. In more intensive methods of culture the difficulty was avoided by a suitable rotation of crops. Potatoes subject to early and late blight would be followed by an entirely different crop —possibly peas—which was not at all subject to the same diseases, and would then die out for want of a host, the heavy demand on plant-nutriment in the soil being made up by generous applications of manures. Much of the land in this country—too much, possibly—devoted to horticultural crops is very high-priced owing to its situation within town boundaries — circumstances which compel the grower to confine his attention to those crops only that give a maximum return. A position which is more acute still is where the crop is grown in land under glass. Scientists have devoted a great deal of time during recent years to meet the position, and our correspondence shows a keen demand for this class of information.

In the application of steam to the soil, under right conditions, we have a wonderfully effective remedy, the only objection to which is its cost, although where there are a sufficient number of growers of crops

under glass in a locality they might well co-operate in securing an outfit for mutual use. Small quantities of soil may be sterilized by baking it in a pan in an oven before sowing the seed, or placing the box over a sink and pouring a gallon or two of boiling water into it as fast as the soil will take it up, afterwards standing it aside till sufficiently dry for sowing.

With chemicals we have much less certain agents, although good work has been done. While many chemicals when applied to the soil act to a certain extent both as a fungicide and an insecticide, it is well to clearly ascertain the character of the primary trouble to be dealt with before selecting a chemical remedy. For instance, eelworm, insect larvæ, and fungus in the soil require distinctive treatment.

Where eelworm is the main trouble, experience has shown carbon bisulphide to be the best chemical remedy. Use it at the rate of 6 oz. per square yard, pouring it into a number of holes about 5 in. deep; then fill and tamp the holes. Afterwards water the ground if the surface is loose or dry. A good method of doing this is to mark off the land in lines 1 ft. apart, cross-mark them by the same distance, and make the holes at the intersections, pouring in two-thirds of a fluid ounce of the chemical, an assistant following filling in and tamping the holes. For a glasshouse 100 ft. by 25 ft. 10½ gallons of carbon bisulphide would be required. A useful non-poisonous fungicide for this purpose is a 1–100 solution of formalin (formaldehyde), applying about 1 gallon of mixture per square foot. Two or three weeks should elapse before sowing or planting the land so treated.

Growers who are not suited by these methods might try the "Cheshunt Compound." It contains 2 oz. copper sulphate (bluestone) and 11 oz. ammonium carbonate reduced to a fine powder and thoroughly mixed. Store it in a dry state in a tightly corked glass or stone jar for at least twenty-four hours before using. A solution is prepared by dissolving 1 oz. in a little hot water, and making up to 2 gallons with water. Water the infected soil, after which immediate planting may follow. Infected soil may be treated after seeds or plants are in position. This is specially recommended for fungi causing "damping-off" and root troubles.

As tomato-growers will now be commencing another season, the foregoing information will be useful to many. During the season just past "damping-off," black-stripe, fusarium wilt, and sclerotinia were very troublesome in places. Fruit affected with the latter disease was very noticeable. It is quite true that "prevention is better than cure," and the best treatment is good drainage and cultivation, and a carefully considered use of manures. Many growers engaged in intensive culture on heavy land might well use more lime, especially for the tomato crop.

VEGETABLES AND POTATOES.

Broad beans may be sown now, and in suitable localities sow peas and plant out lettuce. For early planting seed potatoes should be secured now, spread in trays for sprouting, and stored in a light airy place. Should the potato-moth be about, dip them in a mixture composed of 1½ lb. arsenate of lead and 50 gallons water. Where new land in grass has to be broken in, a commencement should now

be made by skim ploughing and allowing it to lie until the turf is killed. Where available, manure from the cow-sheds and stables should be carted out, and a liberal dressing applied to land that is to be planted out in early potatoes and main-crop cabbage and cauliflower. Plough it in, and commence that thorough preparation which is so necessary.

THE SMALL-FRUIT SECTION.

The pruning of the small-fruit section will now demand attention. Black currants should be pruned to induce an abundance of strong young wood in the bushes; this may be done by cutting back old wood to a bud near the base. Red and white currants require an almost opposite treatment. It is best not to top the main growth in these bushes after the first year or two; maintain an open centre and remove all suckers.

To allow gooseberries to become crowded is fatal to best results. Prune to keep the growth well spread out, and renew the laterals by shortening to base buds those that are old or weak. The carrying-out of these simple directions would bring about great improvement in many plantations of these useful berries.

Raspberry-canes are usually cut out as soon as they have fruited; if this has not been carried out it should be done now, taking care to cut low down, removing also canes that are out of place, and cutting down those that are weak. Owing to the prevalence of cane-wilt and anthracnose, carefully carry out the old canes and burn them.

Much the same treatment is suitable for the loganberry, which is now so popular, with the further addition of training in the new running canes. These are usually divided into four bundles, two being wrapped round and left on a lower wire and secured, and the other two in a similar manner on the upper wire of the trellis.

—*W. C. Hyde, Horticulturist.*

New Rabbit Districts.—The constituting of the following rabbit districts, for the purposes of Part III of the Rabbit Nuisance Act, has been gazetted: Mairoa, Arapae, and Oparure (all in Waitomo County), and Akitio (in the county of that name).

Honey-export Control.—For the purpose of enabling the New Zealand Honey Control Board effectively to exercise a limited control over export, shipment of honey to Europe has been prohibited save by license from the Minister of Agriculture, subject to such conditions as may be approved by the Board.

Wheat and Oats Threshings.—Returns of actual threshings up to 20th April received by the Government Statistician from threshing-mill owners showed that until then 2,810,292 bushels of wheat and 2,991,913 bushels of oats had been threshed out. The average yields per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 34·05 bushels for wheat and 39·73 bushels for oats. The figures for the Canterbury, Otago, and Southland Land Districts respectively were as follows: Canterbury—Wheat, 2,283,580 bushels threshed, averaging 34·66 bushels per acre; oats, 1,636,211 bushels threshed, averaging 38·84 bushels per acre. Otago—Wheat, 427,192 bushels, averaging 31·89 bushels per acre; oats, 691,796 bushels, averaging 40·11 bushels per acre. Southland—Wheat, 42,602 bushels, averaging 32·89 bushels per acre; oats, 515,403 bushels, averaging 43·77 bushels per acre.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

TROUBLE WITH DRAUGHT MARE.

"SUBSCRIBER," Ashburton :—

I would be obliged for advice in connection with a mare about eight years of age. She takes bad turns when in work, at irregular times. As soon as unyoked she stands, sweats all over, and blood-tinged froth runs from both nostrils. These turns pass off in a few hours and she then appears to be quite normal. She is in good condition.

The Live-stock Division :—

This case appears to be an unusual one, and a definite opinion would necessitate a personal examination. From the symptoms described the trouble may be due to a hyperæmia (congestion) of the lungs resulting from overheating by hard or fast work. Injuries to the mucous membrane of the air-passages, or tumours occurring therein, might produce symptoms similar to those described; and bleeding from the nostrils is sometimes a symptom of heart-disease. It is presumed that the collar has been examined, as an ill-fitting one may be a contributory cause; also that care has been taken not to feed with dusty or mouldy fodder, which tends to irritate the mucous membrane. In the circumstances you are advised to consult a qualified veterinary surgeon.

MAKING BASIC SUPER.

L. J. W., Whatoro :—

Please advise me as to the ingredients required and quantity of each for making a ton of basic super.

The Chemist :—

Basic super may be easily prepared by intimately mixing ordinary superphosphate with slaked lime. Fifteen per cent. of lime is sufficient to revert the water-soluble phosphate, therefore 17 cwt. of superphosphate should be mixed with 2½ to 3 cwt. of slaked lime of good quality.

GLASSY CORE IN APPLES.

W. McMULLEIN, Waimamaku :—

Would you kindly inform me what causes apples to have a glassy, watery-looking core? I have some young trees which have been bearing about two years; one variety in particular, an Irish Peach, has been affected both seasons. This tree is a vigorous grower and well looked after.

The Horticulture Division :—

The condition of glassy core in apples is due to excessive water in the affected tissues, and usually is troublesome only in small crops on young trees in particularly vigorous condition. Such fruit stored in a somewhat dry atmosphere for a short time often recovers from the trouble.

SHORT WIND AND FROTHING IN HORSE.

"AGRICOLA," Hinds :—

I have a draught mare which is a good worker but has always been very short-winded (though not a loud roarer), and froths at the mouth a good deal while at work. Even the bottom of the manger is often almost covered with froth which comes from her while she is licking rock salt. She has always been well fed and never overworked by me. Could you kindly give me your opinion and a treatment?

The Live-stock Division :—

The description given is insufficient for forming a definite opinion, but we are inclined to think the short-winded condition is due to the mare being broken-winded, while the frothing at the mouth is probably the result of irregular or sharp teeth. There is no cure for broken wind, but proper dieting helps to alleviate the trouble. We should advise having the mare's mouth examined and attention given to her teeth.

EGGS AND EGG-PULP IN COLD STORAGE.

A RETURN issued by the Government Statistician shows the following stocks in the Dominion as at 31st March, 1925—corresponding figures for the same date in 1924 being added in parentheses: Eggs in shell, 59,698 dozen (44,942 dozen); egg-pulp, 584,601 lb. (840,889 lb.); frozen whites, 1,773 lb. (2,618 lb.); frozen yolks, nil (nil).

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 12th March to 23rd April, 1925, include the following of agricultural interest :—

No. 53287: Milking-machine teat-cup support; E. Sattler, Hurleyville. No. 53293: Wire-strainer; Donald and Sons, Ltd., Masterton. No. 50814: Axe-handle guard; W. Wilkey, Riversdale. No. 51979: Insect-destroying; American Cyanamid Co., New York. No. 52970: Chaffcutter-feed; W. Bishop, Ballarat, Victoria. No. 51717: Sheep-dipping bath; B. F. Mitchell, Auckland. No. 51725: Milking-machine releaser; D. M. Wallace, Ltd., Te Aroha. No. 51917: Flax-fibre bleaching; P. M. Thompson, Green Island. No. 53536: Milking-machine milk-measuring and sample-obtaining device; H. Bodley, Wellington. No. 51525: Shearing-machine hand-piece; H. V. Rutherfurd, Ashhurst. No. 51676: Identifying cows with their milk tests; M. C. Drabble, Pongakawa. No. 52922: Cream or milk aerating; T. Topliss, Greymouth. No. 53636: Disk plough; G. F. Shave, Lyndhurst South, Victoria. No. 53967: Flax-treatment; L. C. Chaytor, Spring Creek.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price, 1s.

FRUIT-EXPORT CONTROL.

THE following regulations under the Fruit Control Act were gazetted on 23rd April:—

(1.) The maximum fees payable to members of the New Zealand Fruit-export Control Board, constituted under Part I of the said Act, shall be as follows: Chairman, £50 per annum; other members, £25 per annum. Provided that when the Chairman or any other member is engaged on the business of the Board in the Dominion, other than that connected with ordinary Board meetings, the following additional fees shall be payable: Chairman, £2 2s. per diem; other members, £1 1s. per diem.

(2.) The maximum rate of travelling-allowance payable to members of the said Board shall be £1 per diem, plus actual locomotion expenses.

(3.) The charge payable by way of levy on all fruit produced in a district in which Part I of the said Act is for the time being in operation and intended for export shall be as under :—

Capacity of Case.	Levy per Case.
Half-bushel and under	0½d.
Exceeding half-bushel but not greater than one bushel	1d.

(4.) Any moneys payable under clause 3 hereof shall be paid to the Board immediately upon the shipment of the fruit from the Dominion.

An Order in Council, issued in the same *Gazette*, fixed 23rd April as the date on which the above-mentioned levy or other similar charges prescribed from time to time by regulation should become payable.

WEATHER RECORDS: APRIL, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during April was, on the whole, fine, dry, and sunny, with rainfall generally below the average. In parts of Canterbury, however, the total falls were very much higher—for example, the 6·25 in. recorded at Christchurch is over three times the mean for the month. This result was owing chiefly to the passage between the 15th and 19th and the subsequent extension of a cyclonic storm off the east coast. The same remarkable tendency to intensify, after passing over the country, was evidenced about ten days earlier, so that in a brief period Canterbury experienced an unusual succession of stormy southerly weather. The east coast of the North Island mostly escaped, and the total month's fall at Napier was only 0·18 in. for three days, with bright sunshine amounting to 229 hours, and no sunless days.

—*D. C. Bates, Director.*

RAINFALL FOR APRIL, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average April Rainfall.
	North Island.			
	Inches.		Inches.	Inches.
Kaitaia	1·96	11	0·54	3·55
Russell	3·46	12	1·63	3·39
Whangarei	2·21	15	0·53	4·95
Auckland	1·28	13	0·27	3·34
Hamilton	1·04	12	0·22	3·64
Kawhia	1·90	11	0·38	4·75
New Plymouth	1·83	11	0·90	4·57
Riversdale, Inglewood	3·45	13	0·72	8·39
Whangamomona	3·76	11	0·84	6·68
Tairua, Thames	2·04	11	0·48	5·88
Tauranga	1·68	15	0·80	4·47
Maraehako Station, Opotiki ..	2·16	11	0·42	5·22
Gisborne	1·01	9	0·39	4·26
Taupo	1·12	6	0·68	3·95
Napier	0·18	3	0·13	2·17
Maraekakaho Station, Hastings ..	0·21	5	0·13	3·14
Taihape	0·93	10	0·32	3·37
Masterton	1·60	9	0·54	3·18
Patea	1·48	11	0·47	3·95
Wanganui	0·60	3	0·45	3·59
Foxton	2·02	9	0·50	2·57
Wellington	2·62	10	0·83	3·86
	South Island.			
Westport	4·27	16	1·10	6·50
Greymouth	5·28	13	0·98	8·83
Hokitika	7·72	14	2·92	9·31
Arthur's Pass	11·21	6	3·87	17·64
Okuru, Westland	16·08	11	2·50	13·67
Collingwood	..	..	..	8·07
Nelson	1·90	7	0·74	2·93
Spring Creek, Blenheim ..	0·78	7	0·40	1·91
Tophouse	3·00	8	1·45	4·03
Hanmer Springs	2·68	7	1·55	3·27
Highfield, Waiau	2·61	6	1·91	2·85
Gore Bay	2·70	7	0·65	2·02
Christchurch	6·25	9	4·71	1·91
Timaru	2·10	7	0·94	1·49
Lambrook Station, Fairlie ..	..	..	..	2·00

RAINFALL FOR APRIL, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Benmore Station, Omarama ..	0·89	8	0·62	2·52
Oamaru	1·66	6	0·54	1·76
Queenstown	2·23	9	0·85	2·92
Clyde	1·18	8	0·18	1·34
Dunedin	2·44	16	0·66	2·72
Gore	3·35	14	0·67	3·26
Invercargill	4·72	20	0·90	4·43

PLANTS, BULBS, ETC., FOR CANADA.

THE following memorandum was issued by the Destructive Insect and Pest Act Advisory Board of Canada, dated Ottawa, 21st February, 1925:—

"It has been brought to our attention by both the Customs and Post Office Departments that shippers of nursery stock from countries other than the United States are not complying with the regulations dealing with the forwarding of parcel-post shipments. Section X of Regulation 1 (Foreign) distinctly states that all such shipments must have an official label, furnished by this Board, attached to the package. No other label should appear thereon, but the shipper is advised to place a label *inside* the package giving the name and address of the ultimate consignee. Packages with two labels are frequently forwarded direct to destination, and then have to be returned to either Montreal or Vancouver for inspection, in which case the importer is required to pay the cost of postage both ways."

It will be seen that it is necessary for senders of such material by parcel-post to communicate with and obtain the necessary label or labels from the above-mentioned Board before making the despatch.

IMPORTATION OF FERTILIZERS: MARCH QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 31st March, 1925: *Sulphate of Ammonia:* United Kingdom, 50 tons; Australia, 60 tons. *Gypsum:* Australia, 45 tons. *Nitrate of Soda:* Chile, 40 tons. *Basic Slag:* United Kingdom, 5,245 tons; Belgium, 9,194 tons; Germany, 250 tons. *Bonedust:* Australia, 230 tons; India, 630 tons. *Chardust:* Australia, 45 tons. *Guano and Rock Phosphate:* Nauru Island, 27,851 tons; Ocean Island, 5,629 tons. *Phosphates, other:* Egypt, 2,468 tons. *Kainit:* United Kingdom, 356 tons; France, 128 tons; Germany, 1,160 tons; Belgium, 45 tons. *Sulphate of Potash:* United Kingdom, 136 tons; France, 30 tons; Germany, 327 tons. *Muriate of Potash:* Belgium, 1 ton. *Potash, other:* United Kingdom, 230 tons; France, 70 tons; Germany, 370 tons. *Sulphate of Iron:* Australia, 28 tons. *Other Manures:* United Kingdom, 1 ton; Australia, 1 ton; Canada, 1 ton.

TOP-DRESSING OF PASTURE FOR IRON-HUNGER.

IN connection with the suggestions for curative top-dressing made in the *Journal* for March, p. 186, it is advisable to emphasize that if basic slag and sulphate of iron are mixed, the mixture should be made up in small quantities as required for immediate application; or if left standing for any time it should be spread in a thin layer on the mixing-floor. This mixture if left in bulk or in bags is liable to develop considerable heat, with the formation of a hard mass that can be broken up again only with great difficulty.—*Chemistry Section.*

GRASS- AND CLOVER-SEEDS HARVEST, SEASON 1924–25.

THE following brief survey of this season's harvest in New Zealand of the principal grass and clover seeds grown is supplied by Mr. N. R. Foy, the Department's Seed Analyst:—

Rye-grasses.—Perennial: A good crop of heavy-weight seed was harvested in Southland; in Canterbury the crop was poor; in the Sandon district the yield was good and the seed nice in appearance, but the germination poor; Hawke's Bay and Poverty Bay had an average yield of good-quality seed. Western Wolths and Italian: Good crops of excellent-quality seed.

Cocksfoot.—Akaroa: Short crop of very light seed. Plains: Good average yield of fair-quality seed.

Crested Dogstail.—Small crop of good-quality seed.

Danthonia.—Yield good, and seed particularly good, especially that from Canterbury.

Chewings Fescue.—Fairly short crop of average quality.

Brown-top.—Good crop of nice-quality seed in the North. Apparently very little was harvested in Southland.

Cow-grass.—Medium yield of average quality in Marlborough. In Canterbury the crop was poor generally, although the seed is of good quality.

White Clover.—Medium yield in Marlborough, and a poor harvest in Canterbury. Supplies will probably be a little short this year.

POULTRY IMPORTATION AND FOWL-PEST.

AN Order in Council gazetted on 7th May prohibits, save under permit issued by the Minister of Agriculture, the importation into New Zealand of poultry (including domestic fowls, ducks, geese, and turkeys) from any country other than the Commonwealth of Australia, unless each lot is accompanied by an official certificate from the country of export that fowl-pest (*Pestis gallinarum*) has not been known to occur in that country during a period of two years preceding date of certificate.

Fowl-pest is an acutely infectious disease caused by an ultra-microscopical virus, and in its course resembles chicken-cholera. It is usually fatal, no effective treatment being known. The disease was first reported from northern Italy, afterwards from Tyrol, Germany, Belgium, and France, and later from England. It has recently spread to the United States, and drastic measures have been put into force to suppress it. Canada has already issued regulations aimed at excluding the disease from her territory. It will therefore be recognized that restrictions on importation to this country are essential for the safety of our poultry industry.

FORTHCOMING WINTER SHOWS.

Otago A. and P. Society: Dunedin, 2nd to 6th June.
Waikato Winter Show Association: Hamilton, 2nd to 6th June.
Manawatu A. and P. Association: Palmerston North, 16th to 20th June.
Wanganui A. and P. Association: Wanganui, 24th to 27th June.
Poverty Bay A. and P. Association: Gisborne, 25th to 27th June.
Wellington Winter Show Association: Wellington, 30th July to 15th August.
Auckland Winter Exhibition: Auckland, 15th to 22nd August.

Ruakura Pedigree Stock Sale.—At this year's annual sale, held on 8th April, Milking Shorthorn cattle sold fairly well, but there appeared to be very little demand for Jersey bulls. The demand for Berkshire pigs was very keen. Following are average prices obtained for the stock sold: Shorthorn bulls, £34; Shorthorn heifers, £24; Jersey bull, £21; Berkshire boars, £8 5s.; Berkshire sows, £7 5s.

The New Zealand

Journal of Agriculture.

Vol. XXX.—No. 6.

WELLINGTON, 20th JUNE, 1925.

THE GRASSLANDS OF NEW ZEALAND.

(Continued.)

PRELIMINARY ECOLOGICAL CLASSIFICATION OF SPECIES.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

For uncounted ages Nature has been modelling the plant population of the earth, and the effort has been to clothe every feature of the earth's surface with some class of vegetation. In our own wonderful forests we see Nature's handiwork: how she works up from one type of vegetation to another, retaining the hardier type of plants where conditions remain hard, and building gradually towards a greater and more luxuriant vegetation as conditions for plant-life are made easier through modification of the environment. Just how these modifications in the environment occur, and just how Nature works in the modelling of the plant cover to suit altered conditions, does not concern us here. It is plain for all to see that for every soil and climatic type in natural New Zealand there is a different plant, or set of plants, dominant in the vegetation. In our pastures also, although these are made up mainly of species of plants from floras other than our own, yet we must realize that each plant is the product of ages of natural selection and modification, each built to suit certain aspects of soil and sets of environmental conditions.

The endeavour of this article is to classify, under as many heads as possible, the commoner pasture-plants, so that we may the more

readily see just which soil type and which set of environmental conditions suit the growth and proper development of each species. There are seven main factors that govern dominance or subjection of any one species, or set of species, in our pastures: (1) Soil-fertility; (2) soil-moisture content; (3) intensity of light and shade; (4) climatic conditions; (5) growth-form of the plant; (6) seasonal growth of the plant; (7) palatability of the plant. A consideration of each of these factors will show the extent to which each influences the change or stability that occurs in the pastures.

THE SOIL-FERTILITY FACTOR.

In a previous article in this *Journal*—May, 1924, pp. 294–300—it was pointed out by the writer that each grassland species demands the maintenance of a certain standard of soil-fertility in order that that species may thrive. Some species demand a high standard of fertility; others thrive well under a very low standard of fertility. In Table 1 of the present article an effort has been made to show how the fertility factor governs dominance or subjection among grasses and clovers that constitute our grasslands. An inspection of the table will show the important part the fertility factor plays in deciding just which species or set of species will form the dominant herbage of the permanent pasture. If, for example, all the species enumerated in the table were sown on fertile, damp soil, it would be found in the course of time, provided fertility were maintained, that the grasses at the head of the list would dominate all the rest. Again, if the whole of the species were sown on soils not quite so fertile nor so damp we should find that the species a little lower down in the list would become dominant, and just so long as the fertility were maintained at a constant high level the composition of the pasture would remain constant.

Now, supposing the fertility of the country was up to the perennial rye-grass standard, and there set in a gradual reduction of fertility, it would be found that the rye-grass would soon begin to dwindle, and its place as the dominant of the pasture would be usurped by a plant or plants lower down in the list—possibly by cocksfoot. Cocksfoot would thrive and persist as the dominant just so long as the fertility present in the soil was sufficient to keep it growing strong and vigorous. A further reduction in fertility would see this species in its turn dwindle, and there would be a corresponding opening-up of the turf. A grass such as brown-top would now come to the fore and become the dominant. As the fertility became more and more reduced, however, brown-top in its turn would become stunted, presenting then a dry, matted, low-production pasture. From this point the running would most probably be taken up by Danthonia pilosa, associated with the lower-production clovers. In North Auckland Danthonia pilosa, on the poorer knolls, gives place to Danthonia semiannularis, or it might be quite overrun with the useless hair-grass. These latter plants dominant in a pasture would possibly represent the lowest state of soil-fertility it were possible to get in our artificial grasslands.

This illustration just serves as an example of what may happen as fertility falls. If the low-fertility-demanding grasses are not present on the area or are prevented from migrating on to it, low-fertility-demanding weeds will then take up the running in their stead. Weeds

Table 1.—Showing the Commoner Species of Grasses and Clovers arranged in Descending Order according to Soil-fertility Requirement (the topmost species demanding the highest state of fertility, the bottom ones the lowest state).

(The plus sign indicates dominance; the minus sign indicates subjection.)

Name of Pasture-plant.	Extremely High Fertility.	High Fertility.	Moderately High Fertility.	Average Fertility.	Moderately Low Fertility.	Low Fertility.	Very Low Fertility.
Meadow-foxtail	+	+	+	—	—	—	—
Poa trivialis	+	+	+	—	—	—	—
Prairie-grass	+	+	+	—	—	—	—
Tall fescue	+	+	+	—	—	—	—
Timothy	+	+	+	+	—	—	—
Alsike	+	+	+	+	—	—	—
Red clover	+	+	+	+	—	—	—
Italian rye-grass	+	+	+	+	—	—	—
Meadow-fescue	—	+	+	+	—	—	—
Perennial rye-grass	—	+	+	+	—	—	—
White clover	—	+	+	+	+	—	—
Paspalum	—	+	+	+	+	+	—
Yorkshire fog	—	+	+	+	+	+	—
Cocksfoot	—	—	+	+	+	—	—
Crested dogstail	—	—	+	+	+	—	—
Poa pratensis	—	—	+	+	+	—	—
English trefoil	—	—	+	+	+	—	—
Strawberry-clover	—	—	+	+	+	—	—
Red-top	—	—	+	+	+	—	—
Tall oat-grass	—	—	+	+	+	—	—
Poa nemoralis	—	—	+	+	+	+	—
Brown-top	—	—	—	+	+	+	—
Lotus major	—	—	—	+	+	+	—
Subterranean clover	—	—	—	+	+	+	—
Yarrow	—	—	—	+	+	+	—
Sweet vernal	—	—	—	+	+	+	—
New Zealand rice-grass ..	—	—	—	—	+	+	+
Danthonia pilosa	—	—	—	—	+	+	+
Ratstail	—	—	—	—	+	+	+
Chewings fescue	—	—	—	—	+	+	+
Lotus hispidus	—	—	—	—	+	+	+
Suckling-clover	—	—	—	—	+	+	+
Clustered clover	—	—	—	—	+	+	+
Haresfoot trefoil	—	—	—	—	—	+	+
Danthonia semiannularis ..	—	—	—	—	—	+	+
Grimmer-grass ..	—	—	—	—	—	+	+
Bay-grass	—	—	—	—	—	+	+
Hair-grass	—	—	—	—	—	+	+

or low-fertility grasses and clovers coming into a pasture indicate almost certainly that the fertility of that soil is becoming exhausted. (See also page 368 of this article regarding effect of close and continuous grazing.)

It will be seen from the foregoing that a reduction in fertility brings about a change in dominance of the different species or sets of species. But what happens to those species when their place as dominants is usurped by another? I think it is fairly safe to say that if we examined the turf, even when the fertility has fallen as low as it is possible to fall, we would still find some remnants or vestiges of the former dominants. Now, just as the composition of the pasture changes during a reduction of fertility, so does the composition change as the fertility of the soil becomes increased. Increasing the fertility of a danthonia sward, for example, does not lead to an enormous growth of danthonia, but rather to a change in the composition of the pasture. Again, as soon as the soil-fertility of brown-top pastures is improved we see white clover increase. A little later crested dogstail, cocksfoot, and even rye-grass will manifest themselves, and will vie successfully for place along with the brown-top. Each step of soil-fertility increase, therefore, will be marked by the re-entrance of additional species higher in the production scale—that is, provided these species have been included in the original sowing. In other words, as soon as fertility is increased up to the standard of the better grasses and clovers these gradually reappear, and so long as the maintenance of fertility goes on these will become strong and vigorous again and will gradually replace the poorer elements of the pasture.

One sees this happening in New Zealand in almost every pasture that is being liberally and systematically top-dressed. The better grasses and clovers will come back, and will dominate the pasture just so long as they are liberally fed. It has been the custom for farmers to abuse the inferior grasses and clovers that come into their pastures, and which, according to them, "oust the better grasses." The plain truth, I think, is this: that the better grasses and clovers have been starved through lack of plant-food, and so weakened thereby that the entry of inferior grasses and low-fertility-demanding weeds was made possible. If the farmer will only feed his better grasses and clovers sufficiently with artificial manures, &c., there is virtually no danger of their ever being replaced by inferior grasses and weeds.

Yet one must not lose sight of the economics of the situation. On soils naturally fairly fertile, and where the moisture is plentiful, I should say it would be possible and economically sound to maintain fertility well up to the rye-grass standard. But on naturally poor soils, should the rye-grass sward there be the objective, or must one be satisfied with something lower in production but which will thrive well under poorer and harder conditions? On poor soils, then, on difficult, rough country, is it sound to aim at a high-production pasture costly to obtain and to maintain, or should we aim at a lower-production pasture that is easier and surer to get and cheaper to maintain? These are questions calling aloud for economic investigation, and until such work is carried out we do not know whether on poorer, difficult country it pays to build up fertility so that the higher-production pastures may result. One thing seems certain, that until such time as artificial manures become cheaper and facilities for applying are improved the

greater portion of the difficult hill country must be satisfied with a sward of low-fertility-demanding grasses and clovers. Even on these areas, however, experiment may prove the possibility of improving in one way or another the fertility of the soil, and then will be seen, just as in the case of the ploughable areas and easier hill country, a return of the higher-producing grasses and clovers.

THE FACTOR OF SOIL-MOISTURE CONTENT.

The second great factor that helps to decide dominance or otherwise in our pastures is the soil-moisture content. When the arrangement of the species is studied under this head (Table 2) it becomes obvious that the arrangement coincides very closely with that in Table 1. A soil is fertile only so long as the plant-food contained therein is in solution. Therefore, as soon as a soil becomes dry it becomes barren, incapable of supporting plant-life. Most of our grasses and clovers are very shallow feeders, and dry weather for any length of time means a reduction in available fertility at the surface. Thus it is found that in a dry district hardy, low-fertility-demanding grasses are the rule. In districts of very low rainfall, such as Central Otago, are soils virtually barren until the all-important moisture content is improved by irrigation. Once the water is got on to those soils heavy crops of high quality result. In Hawke's Bay, again, in a dry season available fertility is low and the predominating vegetation of the hill pastures appears to be danthonia; but in the early spring and right throughout a wet season a decided increase in the rye-grass and white-clover content can be noted. The soil-moisture content of a pasture therefore largely regulates the composition of the pasture, for upon this factor depends the amount of plant-food that is rendered available.

In a wet climate where there is sufficient moisture in the soil to render available plant-food contained therein, just so long as the supply of plant-food lasts there will persist the high-production grasses and clovers. But it must be borne in mind that while a soil is moist there is a continual drain on the supply of plant-food contained in it, and thus soils in a wet district are more likely to become exhausted of their fertility quicker than those where periodical dry spells arrest the outgo of plant-food. Therefore top-dressing with artificial manures, or the adoption of some method to maintain fertility, is more necessary in wet than in dry districts. Generally speaking, this has been proved in practice, artificial manures almost invariably giving better results in a wet district than in a dry district. The loss of fertility in a wet district by leaching also must be made good.

In agricultural development the regulation of the moisture factor by drainage has received a great deal of attention, and rightly so, in all classes of agricultural land where cultivation and cropping are being carried out. So far as our grasslands are concerned, while drainage often is an essential, yet I am of the opinion that there is such a thing as overdrainage. Reference to Table 2 will show that high-yielding grasses like meadow-foxtail, Poa trivialis, timothy, &c., require a high water content in the soil, and if this is removed by drainage it simply means the farmer must adopt lower-yielding grasses and clovers that can persist under the drier conditions. Again, in the case of soils that are impossible to drain, it is useless sowing down

Table 2.—Showing the Commoner Species of Grasses and Clovers arranged in Descending Order according to Requirement in Soil-moisture Content.

(The plus sign indicates tolerance of wet or dry conditions; the minus sign indicates intolerance of wet or dry conditions.)

Name of Pasture-plant.	Swamp and Flood Area.	Very Wet or Water-logged.	Wet Soils.	Average Degree of Soil-moisture Content.	Fairly Dry.	Extremely Dry.
Floating sweet-grass	+	+	−	−	−	−
Poa aquatica	+	+	−	−	−	−
Creeping-bent	−	+	+	−	−	−
Paspalum	−	+	+	+	+	−
Lotus major	−	+	+	+	+	−
Yorkshire fog	−	+	+	+	+	−
Tall fescue	−	+	+	+	−	−
Meadow-foxtail	−	+	+	+	−	−
Poa trivialis	−	+	+	+	−	−
Timothy	−	+	+	+	−	−
Meadow-fescue	−	+	+	+	−	−
Alsike	−	−	+	+	−	−
Prairie-grass	−	−	+	+	−	−
Red-top	−	−	+	+	−	−
Brown-top	−	−	+	+	+	−
Sweet vernal	−	−	+	+	+	+
Italian rye-grass	−	−	+	+	+	−
Perennial rye-grass	−	−	+	+	+	−
White clover	−	−	+	+	+	−
Crested dogstail	−	−	+	+	+	−
Cocksfoot	−	−	+	+	+	−
Poa pratensis	−	−	+	+	+	−
Red clover	−	−	+	+	+	−
Strawberry-clover	−	−	+	+	+	−
Subterranean clover	−	−	+	+	+	−
English trefoil	−	−	+	+	+	−
Poa nemoralis	−	−	+	+	+	−
Tall oat-grass	−	−	+	+	+	−
Lotus hispidus	−	−	+	+	+	+
Chewings fescue	−	−	+	+	+	+
Yarrow	−	−	−	+	+	+
New Zealand rice-grass	−	−	−	+	+	+
Danthonia pilosa	−	−	−	+	+	+
Ratstail	−	−	−	+	+	+
Bay-grass	−	−	−	+	+	+
Suckling-clover	−	−	−	+	+	+
Haresfoot trefoil	−	−	−	−	+	+
Grimmer-grass	−	−	−	−	+	+
Danthonia semiannularis	−	−	−	−	+	+
Hair-grass	−	−	−	−	+	+

those areas with species that will not tolerate wet conditions. Perennial rye-grass, for example, will not stand "wet feet" in the winter, and where the effort is to keep this grass as the dominant permanent element of the pasture the surface water must be removed by drainage. An alternative to drainage, however, would be to use wet-tolerating grasses such as meadow-foxtail, Poa trivialis, timothy, or paspalum. On certain parts of the Hauraki Plains, and on other low-lying areas in New Zealand where the winter conditions are often too wet for perennial rye-grass to thrive, the use of this grass alone leads to an opening-up of the turf in the winter and to an incoming of buttercup, pennyroyal, rushes, &c. If, on the other hand, wet-tolerating grasses such as those mentioned were used there would not be such opening-up of the pasture turf during the wet period, with the result that none of the weeds mentioned above would gain entrance into the pasture. To keep meadow-foxtail and its associates thriving well, however, the soil-fertility must be maintained at a high standard. Paspalum will thrive on soils very much lower in fertility.

From a comparative study of Tables 1 and 2 it will be seen that so long as there is a fairly high degree of moisture in the soil the farmer can do almost anything by the use of artificial manures, as far as regulating the composition of his pastures is concerned; but just so soon as a soil becomes dry he is impotent to effect that improvement by artificial manures alone. In dry districts, therefore, methods of fertility increase, and pasture-improvement must be along lines of moisture-conservation rather than in the application of artificial manures alone. The moisture in the soil is of no value if there is no plant-food there to be rendered soluble, nor is plant-food in the soil of any value if the soil-moisture factor is absent.

THE FACTOR OF LIGHT AND SHADE.

In any natural vegetation, in the establishment and regeneration of forests, and in the succession that takes place within those forests perhaps the most important factor of all governing change is the relative intensities of light and shade. In our grasslands the same principle is at work, and is one of the governing factors in pasture establishment and succession. In Table 3 an attempt has been made to group the commoner pasture-plants according to light and shade requirement of the different species.

It has been already pointed out that pasture-plants with their crown at or above ground-level are liable to extinction by close and continuous grazing. This is particularly true of shade-demanding grasses. Glancing at the table it will be readily noticed that the light-loving grasses are mainly those of hard situations, and are of low production. The better grasses of many pastures owe their extinction as producers largely to an excess of light getting at the crown under the bad practice of close and continuous grazing. Spelling for a whole season, or intermittent spelling and grazing, allows foliage-development which creates shade for the crown. Under such treatment shade-demanders again become strong in a pasture, and light-loving plants gradually weaken. The persistence of cocksfoot on Akaroa hill country can be very largely attributed to the fact that each year these areas

Table 3.—Showing the Commoner Species of Grasses and Clovers arranged according to Tolerance or Intolerance of Light and Shade.

(The plus sign indicates tolerance of light or shade; the minus sign indicates intolerance of light or shade.)

Name of Pasture-plant.	Fairly Dense Shade.	Shady.	Somewhat Shady.	Light-intensity of Average Pasture Conditions.	Fairly Open and Sunny Aspect.	Extremely Sunny and Open Aspect.
New Zealand rice-grass..	+	+	+	+	+	+
Lotus major	+	+	+	+	−	−
Prairie-grass	+	+	+	+	−	−
Cocksfoot	+	+	+	+	−	−
Poa trivialis	+	+	+	+	−	−
Yorkshire fog	+	+	+	+	−	−
Tall fescue	+	+	+	+	−	−
Meadow-foxtail ..	+	+	+	+	−	−
Timothy	+	+	+	+	−	−
Poa pratensis	+	+	+	+	−	−
Brown-top	+	+	+	+	+	−
Paspalum	+	+	+	+	+	−
Meadow-fescue ..	−	+	+	+	−	−
Tall oat-grass	−	+	+	+	−	−
Poa nemoralis.. ..	−	+	+	+	−	−
Sweet vernal	−	+	+	+	+	+
Red-top	−	+	+	+	−	−
Italian rye-grass ..	−	+	+	+	−	−
Perennial rye-grass ..	−	−	+	+	−	−
Red clover	−	−	+	+	−	−
Alsike	−	−	+	+	−	−
Subterranean-clover ..	−	−	+	+	+	−
Crested dogstail ..	−	−	+	+	+	−
English trefoil ..	−	−	+	+	+	−
White clover	−	−	+	+	−	−
Strawberry-clover ..	−	−	+	+	+	−
Lotus hispidus ..	−	−	−	+	+	+
Yarrow	−	−	−	+	+	+
Ratstail	−	−	−	+	+	+
Chewings fescue ..	−	−	−	+	+	+
Danthonia pilosa ..	−	−	−	+	+	+
Suckling-clover ..	−	−	−	+	+	
Bay-grass	−	−	−	−	+	
Danthonia semiannularis	−	−	−	−	+	
Grimmer-grass ..	−	−	−	−	+	
Haresfoot trefoil ..	−	−	−	−	+	
Hair-grass	−	−	−	−	+	+

are spelled for the production of seed, and that consequently the sha factor necessary for the prosperity of this grass is provided. Hc often is it noticeable in a hayed field that the bottom has gone out

the pasture—a reaction due almost entirely to the fact that bottom grasses are light-demanders and top grasses are shade-endurers. The shutting-up of the pasture for hay promotes the growth of shade-demanders, and these by their growth create shade detrimental to the light-demanding bottom grasses; consequently there is a reduction of bottom grasses in the pasture and an increase of the top grasses. In districts where cocksfoot is inclined to get away, this grass may often form an almost pure association by its killing out the bottom grasses through the dense shade it creates.

In the establishment of pasture-plants the light factor plays a most important part. Slowly-establishing plants are often killed out in the initial stages of the pasture owing to the fact that light is excluded from them by the more vigorous early-establishers in the pasture. Where the effort is to get light-demanders established as quickly as possible, a regulation of the mixture accordingly should be considered.

A very important aspect of management to exclude weeds gaining entrance into a pasture from seeds—either blown into or lying dormant in the soil—is to exclude as much light at the soil-surface as possible. Very few seedlings will establish in dense shade. Here, again, is where close and continuous grazing of the pasture so facilitates the entrance of weeds. It can be said almost with certainty that the greater number of our pasture weeds come in as a result of keeping the turf too bared to the ground. A few of these may be cited: Rushes, pennyroyal, Scotch thistle, catsear, rib-grass, field-daisy, selfheal, cudweed, piripiri, manuka, &c.

Perhaps it is on the hill country that the light and shade factor acts most potently. In the first place, the worst forms of secondary growth establish only where there is light right to the soil-surface. The removal of the forest by the burn brings the light factor to bear, and unless there has been a very severe fire myriads of secondary-growth plants spring into being—wineberry, fuchsia, hard-fern, water-fern, and bracken-fern being among the most common. If a close sward of grass could be got immediately over the whole soil-surface it is probable that none of these species would establish, but, unfortunately, this is not possible. Irrespective of the care in sowing or of the quantity of seed applied, there are bound to be some small areas where grass-seed has failed to establish. The principle holds, however, that admission of light to the soil-surface is necessary for the establishment of most of the secondary growth of the hill country—and, in fact, for the establishment of most plants from seeds. The problem of secondary-growth control of the hill country, once such growth has become well established, lies either in the establishment among that growth of shade-enduring grasses and clovers, or in its entire removal, so that the light-loving persistent danthonia type of plant may thrive. This has been the lesson taught by the extensive experience of some millions of acres of hill country that have been successfully grassed.

The use of fire, of cattle, and of the slashhook is primarily to the end of allowing light to reach the soil-surface so that grasses striving there may be strengthened, and so that any seeds of the hardier grasses that are there, or that migrate, or are sown there, may have the

necessary light stimulus to spring into being. Where fire can be utilized successfully for the destruction of secondary growth I think there is no doubt that this is the most economical system. Repeated burning hinders the development of most forms of secondary growth, and vastly encourages the spread and development of danthonia and of any other grasses that may be persisting in the shade of the secondary growth. To my mind the solution as regards the great bulk of difficult hill country lies in the establishment on that country of shade-enduring grasses and clovers that will entice stock to work among the secondary growth, and that will carry a fire at any period of the year when the secondary growth is sufficiently dry for that purpose. The establishment of these grasses and clovers on the fern or scrub-infested areas, and repeated burning at every available opportunity, seems the most economical way of bringing the deteriorated country back.

What is wanted, then, are grasses and clovers that will endure shade, that will carry a fire, that will recover rapidly after burning, and are sufficiently palatable to keep stock working on the area. Stock, particularly cattle, go into the secondary growth and break it down by their treading, thus admitting the light on to the ground where any grass or clover plants might be struggling. The objective of cattle is thus much the same as that of burning—namely, the removal of shade so that the grasses and clovers beneath may get the all-essential strength-giving light. It must be borne in mind that we have no grasses and clovers at present that will endure dense shade, and it is only by keeping the secondary growth somewhat down and comparatively open that the shade-intensity of the secondary growth may be reduced to the point at which our best shade-endurers will thrive among it. The light-loving plants, particularly danthonia, will come in almost certainly, even on their own account, once the secondary growth is so controlled that it creates practically no more shade.

THE TEMPERATURE FACTOR.

With the exception of a few species, it may be said that New Zealand is sufficiently temperate for all the commoner species of pasture-plants enumerated in the tables to thrive here. In the colder districts, certainly, growth is slower to come away in the spring, and the seasonal growth is of shorter duration. The temperature factor operates in our grasslands, in so far as the regulation of change among the component species is concerned, mainly to the point of deciding how far south paspalum can be profitably employed in the pasture. The spread of this grass to prime place in New Zealand grasslands is restricted almost entirely by temperature.

THE FACTOR OF GROWTH-FORM.

Growth-form in plants is the outcome of the modelling processes of nature throughout the eons of time. In Table 4 an effort has been made to arrange the pasture species according to their growth-form. It is difficult to summarize growth-form in this way, owing to the great adaptability and plasticity of each species, yet the tabulation gives one some idea of the normal growth-form each pasture species possesses.

Table 4.—Showing the Commoner Species of Grasses and Clovers arranged according to Growth-form.

(The plus sign indicates the presence of a specific character; the minus sign indicates the absence of that character.)

Name of Pasture-plant.	Crown at or above Ground-level.	Crown below Ground-level.	Plant Tufted.	Plant Mat-forming.	With Short Underground Tillers.	With Underground Creeping-stem.	Stoloniferous.
Floating sweet-grass ..	+	−	−	+	−	−	+
Poa trivialis	+	−	−	+	−	−	+
Creeping-bent	+	−	−	+	−	−	+
White clover	+	−	−	+	−	−	+
Strawberry-clover	+	−	−	+	−	−	+
Prairie-grass	+	−	+	−	−	−	−
Timothy	+	−	+	−	−	−	−
Italian rye-grass	+	−	+	−	−	−	−
Cocksfoot	+	−	+	−	−	−	−
Crested dogstail	+	−	+	−	−	−	−
Alsike	+	−	+	−	−	−	−
Red clover	+	−	+	−	−	−	−
English trefoil	+	−	+	−	−	−	−
Sweet vernal	+	−	+	+	−	−	+
Yorkshire fog	+	−	−	+	−	−	+
Lotus hispidus	+	−	*	+	−	−	−
Subterranean clover	+	−	*	+	−	−	−
Suckling-clover	+	−	*	−	−	−	−
Clustered clover	+	−	*	+	−	−	−
Haresfoot trefoil	+	−	*	−	−	−	−
Hair-grass	+	−	+	−	−	−	−
Tall fescue	+	−	+	−	−	−	−
Tall oat-grass	+	−	+	−	−	−	−
Ratstail	−	+	+	−	+	−	−
Bay-grass	−	+	+	+	+	−	−
Meadow-foxtail	−	+	−	+	+	−	−
Poa nemoralis	−	+	−	+	+	−	−
Paspalum	−	+	−	+	+	−	−
Danthonia pilosa	−	+	−	+	+	−	−
Danthonia semiannularis ..	−	+	−	+	+	−	−
Chewings fescue	−	+	−	+	+	−	−
Grimmer-grass	−	+	−	+	+	−	−
New Zealand rice-grass ..	−	+	−	+	+	+	−
Brown-top	−	+	−	+	+	+	+
Lotus major	−	+	−	+	−	+	+
Yarrow	−	+	−	+	−	+	−
Red-top	−	+	−	+	−	+	−
Poa pratensis	−	+	−	+	−	+	−
Poa aquatica	−	+	−	+	−	+	−

* Annual plants, erect or more or less trailing.

Growth-form governs persistence or otherwise to a certain extent. Plants with their crown above ground are more liable to be eaten out by stock and are more susceptible to climatic changes, particularly in closely grazed pastures. With few exceptions pasture-plants that have their crown above ground disappear very rapidly from any pasture that is closely and continuously grazed. It has been pointed out before by the writer ("Grasslands of New Zealand" bulletin, p. 12) that the root-system of most grasses is not a permanent accessory to the plant. For each growing season a new root-system is developed, and in the case of grasses that have their crown above ground or at the surface such system has its origin from a node of the creeping-stem of the grass, or from the base of the crown at or immediately below the soil-surface. Drying winds and intense light at the soil-surface hinder the development of new roots, and consequently the growth of the plant is retarded. Close and continuous grazing, therefore, must be regarded as an undesirable practice where it is desired to retain pasture species that have their crown at or above ground-level. With those species that have their crown well below ground and which spread by means of long underground stems or by short underground tillers, close grazing, with its attendant desiccating conditions at the surface, does not affect the system of the plant in the same way. Also, when the root-system is deeper in the soil periodical spells of dry weather have little effect in promoting change in the composition of such pastures.

On hill country and on other difficult soils, such as sand country, peat swamps, &c., where it is extremely difficult, irrespective of what quantity of seed is sown, to get anything like a complete sward right from the offset, the growth-form of the plants sown is of much importance. Tussock-forming or tufted plants, unless of a free-seeding nature, are incapable of much lateral spread, and consequently those places where seed-establishment is impossible, owing to the loose spongy nature of the soil or to its hard and dry surface, either remain open bare patches or become invaded by fern, piripiri, manuka, catsear, or other weeds. In the case of those plants with underground stems or with underground tillers, bare and difficult places in the area sown may ultimately become covered by such plants, which have the means whereby lateral spread is possible. On steep hill country also, where stock readily cut the turf about by their treading, and where soil-movement is rapid once the surface is bared of vegetation, binding grasses are essential. Most of the higher-production grasses that one would like to retain on hill country are of the tufted form, and the binding of these by other pasture-plants to render their displacement more difficult is very worthy of consideration. Again, in the early primary-forest burn, where fertility is high, the tufted-nature plants may grow to a great size and completely cover the ground surface. Then, as soon as depletion of fertility begins, a corresponding shrinkage in size of the tufted plants takes place. Bare spaces appear in the pasture, and here, again, is needed the underground tiller, or the underground creeping-stem, or the overground creeping stoloniferous plant, to fill up these gaps in the turf as shrinkage in size of the tufted plants takes place.

In the sowing-down of arable land to pasture, again, growth-form should be considered, particularly so in districts where pastures are

short-lived and where much cropping is done. Most of the grasses with long underground stems flourish to perfection only while the soil remains loose. Under cultivated conditions, therefore, such plants become very bad weeds. Mention may be made of such grasses as twitch, Poa pratensis, red-top, creeping-fog, yarrow, and brown-top, the eradication of which entails much labour and expense throughout the arable lands of New Zealand that are infested by these plants.

In certain districts advantage is taken of growth-form to rejuvenate certain classes of pastures, either for certain special seed-production purposes or for straight-out grazing. Underground creeping-stem-system plants, as has been already mentioned, thrive best under loose conditions. When the ground becomes consolidated the growth of such species becomes sparse, and it is not until the pasture is broken up again that renewed vigorous growth takes place. The excellent Chewings fescue seed crops produced in Southland are secured on renovated areas simply by ploughing up the old stunted pastures of that grass in narrow furrows. In the North the same practice is adopted for the rejuvenation of sod-bound paspalum pastures, and recently the practice has been very successfully adopted in North Auckland for the renovation of brown-top pastures for seed-production. When this practice is analysed two important factors for plant-growth are brought to bear: (1) By a loosening of the soil, scope is given the underground stems to extend; and (2) of the turf ploughed under, that herbage at the lower side of the furrow soon rots and becomes plant-food for those few plants that survive along the uppermost edge of the furrow. Thus the practice is essentially one leading, as far as the surviving plants are concerned, to an increase of fertility.

Stoloniferous plants in general, unless these are capable of sending down strong roots from the creeping-stem, feel the pinch of dry conditions very readily. Poa trivialis, white clover, and strawberry-clover, for example, cease to flourish when conditions become at all dry at the surface. Certain of the hardier forms of stoloniferous plants, however, like kikuyu, buffalo-grass, and Indian doob, spread fairly readily under rather dry conditions.

A useful adaptation of nature is seen in those plants that tide over a crucial period in their yearly cycle by the free formation of seed. This trait is very evident in the annual type of pasture-plants. One is apt to look upon the annual as a fickle, unstable class of vegetation, whereas, in fact, annuals are most persistent. They are the colonizers and successful occupiers of dry, hard, difficult situations untenable by many of the perennial type of plants. Generally speaking, a large annual population in our pastures indicates either that there is a fairly long crucial period in the yearly cycle of that pasture, or else that there exists in the pasture a more or less open association due either to the absence of perennial plants or to the fact that what perennials are present are not thriving sufficiently well to form a dense sward. In first-class grasslands where the ground is always covered by vigorous perennial plants annuals have very little chance. For the seed of the annual to re-establish in the autumn a somewhat open type of pasture, with light penetrating well on to the ground surface, must rule. An increase in the annual population in our permanent pastures, therefore, must generally be regarded as indicating a

weakening and opening-up of the permanent-pasture sward, due either to uncontrollable climatic conditions ruling or to a depletion of soil-fertility.

THE SEASONAL-GROWTH FACTOR.

Theoretically, the ideal pasture would be that which contained a number of species whose seasonal growth varied so that there would be provided a uniform and continuous growth throughout the whole year. In practice such a pasture is exceedingly difficult to secure. So many factors are at work that, should a grass or a clover become markedly dominant at any one period of the year, the pasture containing that species is more likely to become a pure association of it, rather than remain a mixed sward in association with other plants whose growing season came at a different period of the year. For plants successfully to hold their own under strong competition within a mixed association it is almost essential that their growing-periods should coincide almost exactly with one another, else the dormant species is almost certain to be smothered out. In more or less open pastures on low-fertility soils, however, there is frequently noted a marked apparent dominance by individual species in that pasture at different seasons of the year. Thus in a pasture consisting largely of sweet vernal, Danthonia pilosa, and brown-top, in the early spring one would say that sweet vernal was the dominant herbage of that pasture. Later on, when danthonia was in full flower, the dominance would seem to have changed in its favour; and again in the summer and autumn, when brown-top comes to flower and when in seed, it certainly would appear that the pasture was mainly brown-top. If a pasture of this nature were carefully analysed during the maximum growth of each species it would indicate whether or not the apparent dominance was so in actual fact.

An outstanding combination of species of different seasonal growth is well exemplified in paspalum and subterranean-clover pastures. Subterranean clover is essentially an early spring and a fair winter growing clover, while paspalum is essentially a late spring and summer growing grass. By combining the two species there is no doubt that the paspalum pastures are greatly improved. Here any smothering tendency that the subterranean clover may have is of no effect on a strong-growing shade-endurer like paspalum. Again, when paspalum is at its maximum growth subterranean clover is tiding over this smother period as a dormant seed.

Very early spring growing plants—as, for example, annual clovers—may at times have a big influence in promoting change in the permanent pasture. They respond very readily to application of artificial manures, and frequently they are associated with light-demanding grasses. A wet spring, particularly so following top-dressing, may promote such growth that the associate grasses, particularly danthonia, may be completely smothered out.

In Table 5 an effort has been made to arrange the pasture species according to their seasonal growth.

Table 5.—Showing the Commoner Species of Grasses and Clovers arranged according to Seasonal Growth.

(The plus sign indicates maximum growth ; the circle sign indicates moderate growth ; the minus sign indicates little or no growth.)

Name of Pasture-plant.	Early Spring.	Spring.	Summer.	Early Autumn.	Late Autumn.	Mild Winter.	Severe Winter.
Floating sweet-grass ..	+	+	O	O	—	O	—
Poa aquatica	O	+	+	+	O	—	—
Meadow-foxtail	+	+	O	—	O	O	O
Poa trivialis	+	+	—	—	O	O	—
Prairie-grass	+	+	—	—	O	+	O
Italian rye-grass	+	+	—	O	O	O	—
Yorkshire fog	+	+	—	—	O	+	O
Crested dogstail	+	+	—	O	O	O	—
Poa pratensis	O	+	—	—	O	O	—
Sweet vernal	+	+	—	—	O	O	O
Tall oat-grass	O	+	O	—	—	—	—
Danthonia pilosa	+	+	—	—	O	O	O
Danthonia semiannularis ..	+	+	—	—	O	—	—
Subterranean clover.. ..	+	+	—	—	O	O	—
Perennial rye-grass	O	+	—	—	O	O	—
Tall fescue	+	+	O	—	O	O	—
Lotus hispidus	O	+	—	—	—	—	—
Suckling-clover	O	+	—	—	—	—	—
Clustered clover	O	+	—	—	—	—	—
Haresfoot trefoil	O	+	—	—	—	—	—
Hair-grass	+	+	—	—	—	—	—
Timothy	—	+	+	—	O	—	—
Alsike	—	+	+	—	O	—	—
Red clover	—	+	+	O	O	—	—
Meadow-fescue	—	+	O	—	O	—	—
Poa nemoralis	—	+	O	O	—	—	—
White clover	O	+	—	—	O	O	—
Strawberry-clover	—	+	—	—	O	—	—
Cocksfoot	—	+	+	O	O	—	—
English trefoil	—	+	O	—	—	—	—
Red-top	—	+	O	—	O	—	—
Yarrow	—	+	O	—	O	—	—
Lotus major	—	+	+	O	O	—	—
Brown-top	—	+	+	O	O	O	—
Chewings fescue	—	+	—	—	O	O	—
New Zealand rice-grass ..	—	+	O	—	O	—	—
Grimmer-grass	—	+	+	O	—	—	—
Bay-grass	—	O	+	—	—	—	—
Ratstail	—	O	+	O	O	—	—
Paspalum	—	O	+	+	O	—	—

Table 6.—Showing the Commoner Pasture-plants arranged in Descending Order according to Palatability.

(The plus sign indicates a high state of palatability; the circle indicates medium palatability; the minus sign indicates low palatability.)

Name of Pasture-plant.	Young Fresh Herbage.	Somewhat Matured Herbage.	Old and Rank Herbage.	Stunted Ill-natured Herbage.	Herbage matured as Hay.
Timothy	+	+	O	O	+
Meadow-fescue ..	+	+	O	O	+
Italian rye-grass ..	+	+	O	O	+
Perennial rye-grass ..	+	+	O	O	+
Crested dogstail ..	+	+	O	O	O
Poa pratensis ..	+	+	O	O	+
Meadow-foxtail ..	+	+	O	O	+
Poa trivialis ..	+	+	O	—	+
Floating sweet-grass ..	+	+	O	O	+
Alsike	+	+	+	O	+
Suckling-clover ..	+	+	+	O	+
Subterranean clover ..	+	+	O	O	+
White clover ..	O	+	+	O	+
Strawberry-clover ..	O	+	+	O	+
English trefoil ..	O	+	O	—	+
Red clover	O	+	O	O	+
Prairie-grass ..	+	+	O	—	+
Cocksfoot	+	+	—	—	+
Paspalum	+	O	—	—	+
Brown-top	+	O	—	—	+
Red-top	+	O	—	—	+
Danthonia pilosa ..	+	O	—	—	+
Lotus major ..	O	O	—	—	O
New Zealand rice-grass	O	O	O	—	+
Yorkshire fog ..	O	—	—	—	O
Tall oat-grass ..	—	—	—	—	+
Yarrow	O	O	O	—	O
Chewings fescue ..	O	O	—	—	+
Danthonia semiannularis	+	—	—	—	+
Poa nemoralis ..	—	—	—	—	+
Lotus hispidus ..	O	O	—	—	O
Clustered clover ..	—	—	—	—	+
Ratstail	+	—	—	—	+
Sweet vernal ..	—	—	—	—	O
Tall fescue	—	—	—	—	O
Poa aquatica ..	O	O	—	—	+
Hair-grass	O	—	—	—	—
Haresfoot trefoil ..	—	O	—	—	—
Bay-grass	—	—	—	—	—

THE PALATABILITY FACTOR.

The palatability of the plants that constitute the pasture influences to some extent change of dominance in the association. One has only to think of certain weeds of our grasslands the growth and spread of which can be largely attributed to the fact that their foliage is unpalatable to stock: manuka, hard-fern, rushes, &c., will serve as good examples. Among the commoner grassland species there are none entirely neglected by stock, and the relative palatability of each species depends very largely upon management. Generally speaking, the stronger-growing the grass and the less palatable the herbage the greater the care that must be exercised in the management of those pastures.

From Table 6 it will be seen that most grasses are palatable when the growth is young and fresh, and unpalatable as soon as it gets old and rank. Lack of proper management of a pasture that contains certain less palatable species may result in complete dominance of that pasture by such species. Ratstail, for example, once it gets away rank, is very unpalatable to stock, and unless it is chewed down its free-sending attribute soon enables it to spread and to assume complete charge of the pasture. It appears, therefore, that the species in a pasture most inclined to get away should be the one that would decide just what type of management was necessary for the whole of the species in that pasture. In the case of tall fescue one has a grass not only highly unpalatable in the rank state but very subject to ergot, so that the usual method of keeping rank growth down by cattle is not available without considerable risk. Therefore in fertile, wet soils, tall fescue when once established may soon spread and form an almost pure association of useless herbage.

Generally speaking, grasses growing on dry places in the pasture are the first to get away rank, irrespective of whether that grass is cocksfoot or danthonia. Many an aspersion is cast at a danthonia knoll waving white with rank growth, and the grass is condemned as being unpalatable, whereas the person casting the aspersion is probably standing on the very same grass eaten down so well that it is to him "English grasses."

It is often claimed that when a pasture commences to get away stock wander through picking out individual species that are the most palatable. On this assumption it is explained why the better English grasses are never seen much to advantage when growing within a danthonia or a brown-top sward. From the table it will be seen that I consider the stunted ill-natured herbage of the better English grasses as being less palatable than the young fresh herbage of the second-rate species. Now, it is fairly safe to say that if the growth of a pasture is predominately danthonia or brown-top, then the cocksfoot, &c., within that pasture is never at any time very luxuriant, and hence it is never very palatable. What generally happens when a pasture is getting away is that stock do not wander about over the whole pasture picking out individual species so much as they crop close certain patches within that pasture, and keep these close irrespective almost of what species that particular piece of turf is comprised of. In a paspalum pasture, for example, this is very noticeable. It is the small areas that are kept short, irrespective of species, that

prove the most attractive to stock, and therefore it can be assumed that in this state the grasses are most palatable.

CONCLUSION.

In the accompanying set of tables a preliminary ecological classification of our pasture species has been attempted. Not for a moment is it assumed that the classification as presented is correct in every detail; rather is it set out more or less as an outline guide, to be amplified and remodelled as experimental work of an exact analytical nature is performed. Nevertheless it may be claimed that in the tables themselves and in the text is crystallized much information that should be of value to the farmer in his efforts to learn more concerning his pasture-plants.

CEREAL-SMUTS.

AN ILLUSTRATED KEY TO THE NEW ZEALAND SPECIES.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

NUMEROUS requests have been made for the publication of an illustrated key to the cereal-smuts present in New Zealand, so as to facilitate recognition of each species. It is necessary for the farmer to know each species, for on account of certain differences in their life-histories the smuts are divided into two groups, and each group requires a different control treatment. This article has been prepared accordingly. It has been found necessary to supplement the illustrations ~~with certain~~ descriptive matter, calling attention to the salient features of each species, so as to facilitate diagnosis.

Six species of smuts are present on cereals in New Zealand. These may be most conveniently arranged according to the host (the plant attacked by the smut) as follows:—

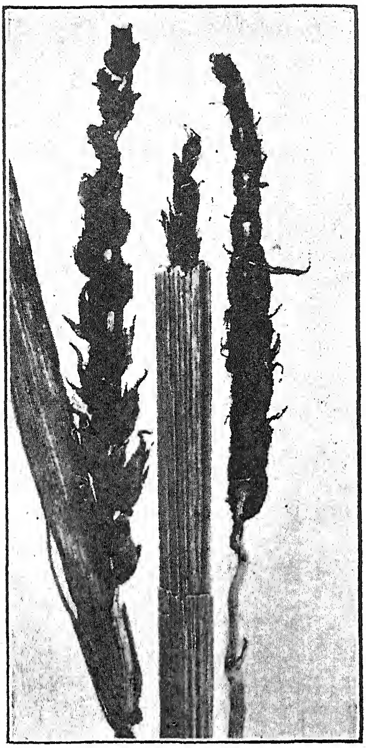
On wheat—
- *Ustilago Tritici* Jens.—loose smut.
- *Tilletia levis* Kuehn and *Tilletia Tritici* Wint.—stinking smut.

On barley—
- *Ustilago Jensenii* Rostr.—covered smut.
- *Ustilago Tritici* Jens.*—loose smut.

On oats—
- *Ustilago Avenae* Jens. and *Ustilago levis* Magn.—oat-smut.

By grouping the smuts in this manner these six species are conveniently divided into three groups. These in turn may be further subdivided according to macroscopic and microscopic characters. For example, the sori (the spore mass of a smut is known as a

* This form on barley is in literature usually named *Ustilago nuda*, but as it is morphologically identical with *U. Tritici* it cannot be considered other than as a synonym, or at least a biologic race. See (1) in "Literature cited" at end of article.



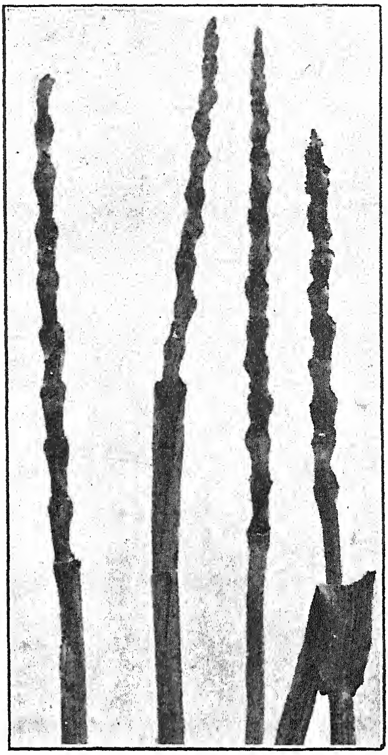


FIG. 1 (LEFT). LOOSE SMUT (USTILAGO TRITICI).
Powdery spore masses in the inflorescences of barley. Natural size.

FIG. 2. LOOSE SMUT.
Remains of infected inflorescences of wheat at harvest-time; the rachis alone remains, the spore mass having been dispersed by wind.

[*Photos by H. Drake.*

" sorus ") may be powdery, forming a black mass covering the entire inflorescence (as *Ustilago Tritici*) ; or may be compact and covered with a transparent membrane, yet visible (as *Ustilago Jensenii*) ; or may be confined to individual ovaries and difficult to detect on account of being covered by the external opaque seed-coat (as *Tilletia Tritici*).

According to these differences in appearance the smuts may be grouped as under :—

On wheat—

Sori powdery, evident..	*Ustilago Tritici*—loose smut.
Sori compact, inevident	*Tilletia levis* and *Tilletia Tritici*—stinking-smut.

On barley—

Sori powdery, evident..	*Ustilago Tritici*—loose smut.
Sori compact, evident..	*Ustilago Jensenii*—covered smut.

On oats—

Sori powdery, evident .. *Ustilago levis* and *Ustilago Avenae* —oat-smut.

This grouping serves to separate *Ustilago Tritici* from *U. Jensenii* and to separate these two species from the others, but does not separate either *Tilletia levis* from *T. Tritici* or *Ustilago levis* from *U. Avenae*, It has been claimed that these are separable on macroscopic characters. but after extended examination of numerous specimens the writer is

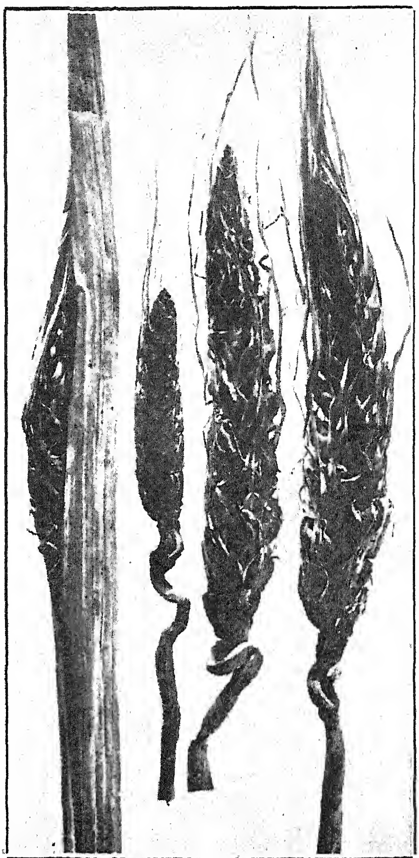


FIG. 3 (LEFT). OAT-SMUT (USTILAGO LEVIS).

The spore masses are held in place by the external glumes. Occasionally the whole inflorescence becomes destroyed by the smut, and this is followed by dispersion of the spores, when the bare rachis alone remains. Natural size.

FIG. 4. COVERED SMUT (USTILAGO JENSENII).

Spore masses in inflorescences of barley. The sori are compact, and when the crop is threshed the spore masses are broken into small portions, those the size of the grains being distributed with the seed.

[*Photos by H. Drake.*

of the opinion that separation may be effected only by the use of the microscope, as follows :—

Spores smooth—
On wheat .. .. *Tilletia levis.*
On oats .. .. *Ustilago levis.*
Spores rough—
On wheat .. .. *Tilletia Tritici.*
On oats .. .. *Ustilago Avenae.*

Fortunately, from the control point of view it is unnecessary to separate these species, for all are controlled by the same treatment,

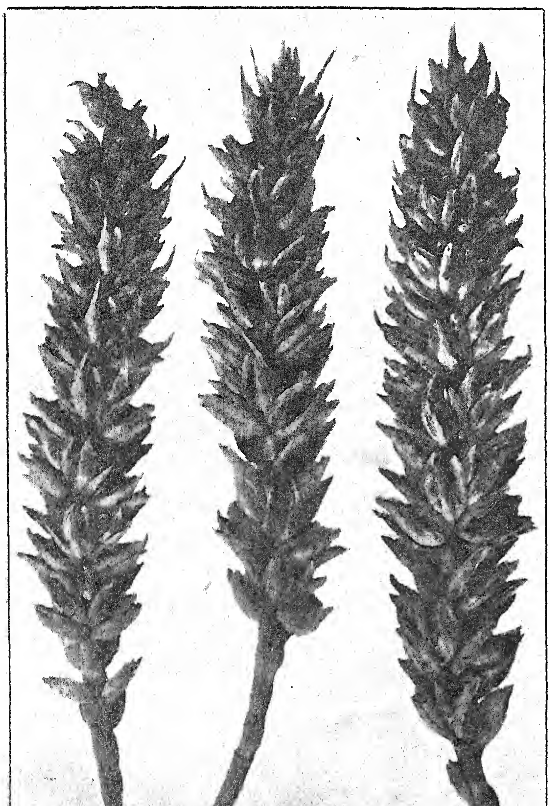


FIG. 5 (LEFT). STINKING-SMUT (TILLETIA TRITICI).

Sori in ovaries of wheat inflorescences. Although infected, these heads appear to differ in appearance little from the normal, save that the glumes are forced apart somewhat.

FIG. 6. STINKING-SMUT.

The glumes have here been removed so as to expose infected grains, and these have been sectioned to show the spore masses.

[*Photos by H. Drake.*

Control measures are dependent on the life-history of the species, and are divisable into two groups according to (*a*) whether the species is disseminated by spores adhering to the exterior of the seed, or (*b*) whether the species is disseminated by hibernating mycelium within the seed.

Smuts disseminated by seed-borne spores are controlled by steeping the seed in a fungicide, or by dusting with a fungicide in powder form; those disseminated by internal mycelium are controlled by steeping the seed in hot water.

The species may therefore be grouped according to the method of treatment as under :—

Hot-water treatment—
Ustilago Tritici—loose smut of wheat and barley.

Steep or dust treatment—
Tilletia levis and *T. Tritici*—stinking-smut.
Ustilago Jensenii—covered smut.
Ustilago levis and *U. Avenae*—oat-smut.

All the species may be treated by the hot-water method, as this treatment would destroy all seed-borne spores in addition to the internal mycelium; but this treatment, owing to the difficulty of application, is usually restricted to those species not controlled by steeping or dusting.

The reader will find full particulars regarding treatments in a series of articles by J. C. Neill published in the *Journal* (see below).

LITERATURE CITED.

(1.) CUNNINGHAM, G. H. The Ustilagineae, or "Smuts" of New Zealand. *Trans. N.Z. Inst.*, vol. 55, pp. 397–433; 1924.
(2.) NEILL, J. C. Stinking-smut of Wheat: The Effect on Germination of some Seed-disinfectants. *N.Z. Jour. Agr.*, vol. 27, pp. 159–67; 1923.
(3.) —— Loose Smut of Wheat: I, Seed-disinfection by Hot Water. *Ibid.*, vol. 29, pp. 177–187; 1924.
(4.) —— Loose Smut of Wheat: II, Field Experiments on Seed-disinfection by Hot Water. *Ibid.*, vol. 30, pp. 167–74; 1925.
(5.) —— Stinking-smut of Wheat: II, Fields Experiments on Control. *Ibid.*, vol. 30, pp. 302–13; 1925.

REPLACEMENT OF TALL FESCUE BY PASPALUM.

THE Northern Wairoa flats, which comprise an area of approximately 120,000 acres, are more or less subject to periodical flooding. Around Ruawai there is a considerable extent of country covered with tall fescue. Of recent years, where the flood-waters have remained on the ground for a couple of weeks, the tall fescue has been killed out and paspalum has replaced it. The paspalum recovers after floods, whereas other grasses common to the district, including tall fescue, are killed out. This replacement is going on naturally, and is not being deliberately carried out by farmers. Where paspalum has charge on these areas it withstands stocking better than English grasses, which are often killed out after floods and their place taken by such weeds as pennyroyal. Even where paspalum has been poached through being stocked after heavy rains and floods it holds and even improves. The interesting point, and one of economic value, is the replacement of a bad weed grass (tall fescue) by a very useful grass in the shape of paspalum.

—*T. H. Patterson, Instructor in Agriculture, Auckland.*

OPEN TEXTURE IN CHEESE.

TRIALS IN CURD-CUTTING WITH BRITISH PEG-MILL.

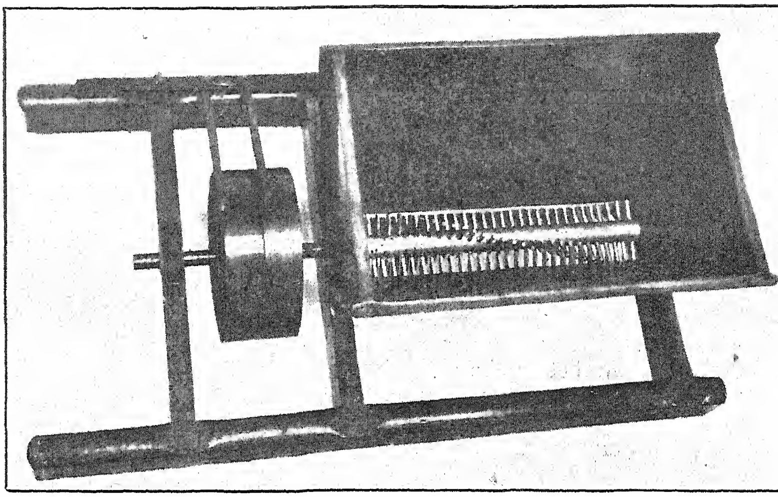
A. McKENZIE, Dairy Instructor, Palmerston North.

THE degree of appreciation which New Zealand cheddar cheese meets with on the British market reflects credit alike on our dairy-farmers and cheesemakers; but when our cheese is compared with that of the highest quality made by the same process in Britain it falls short in flavour and in closeness of texture. The smaller herds, different methods of handling milk, much lesser use of milking-machines, and smaller dairies and factories in Britain are factors favourable to the production of cheese fine in flavour and close in texture. On our part we have ample evidence that the better the condition of the milk delivered to cheese-factories the better the flavour and texture of the resultant cheese. The practice of pasteurizing milk prior to making it into cheese assists our cheesemakers to obtain a better flavoured cheese, but whether pasteurization is resorted to or not the defect of open texture still commonly remains.

Of the many influences bearing on the character of cheese-texture the kind of mill used to cut the cheddared curd is an important one. Mills of various types have been used from time to time, and of these the Harris pattern, locally improved and locally manufactured, has proved the most efficient, and to-day is in general use in New Zealand cheese-factories. It mills the curd quickly with a clean smooth cut, and with the minimum loss of butterfat.

Some little time ago opinion was current to the effect that the texture of our cheese would probably be closer were the curds cut with the type of mill in common use in Britain and known as the peg curd-mill. It was stated that the curd cut by this mill was rough and ragged at the edges, and therefore likely to knit together more closely than curd cut with the local mill. To test this theory a peg curd-mill was imported, and in January last comparative trials with it and the local mill were carried out at a cheese-factory in the Manawatu district.

In carrying out the trials a vat of curd made from pasteurized milk was weighed before milling, and one-half placed in another vat. The first half was milled by the peg mill, and the second by the local mill. The whey from each half of the curd after milling and until five minutes after the cheeses were put to press was collected, weighed, and tested for content of butterfat. The curd after passing through the peg mill was very sticky, lacked firmness, and was most difficult to keep apart. It is safe to say that the curd from an 800-gallon vat would require the combined efforts of four good men to keep it free from lumpiness. The curd cut by the local mill was of the desired firmness, and the handling called for only the customary amount of energy. The butterfat contained in the whey of the curds cut by the peg mill showed nearly 70 per cent. increase over that from the whey of the curds cut by the local mill. The resultant cheese of each milling was examined sixteen days after manufacture, and no difference was noticeable in the texture, but the body of the cheese made from the peg-milled curds appeared to be much drier.



THE BRITISH PEG CURD-MILL USED IN THE TRIALS (VIEWED FROM ABOVE).
[Photo by H. Drake.

The experiments evidenced that the use of the peg mill supplies no remedy for the defect of open texture in cheese. The remedy must be sought for elsewhere. Our dairy-farmers would therefore be well advised to devote all possible attention to the delivering of milk to cheese-factories in the cleanest, coolest, and freshest condition; and our cheesemakers to follow methods of manufacture known to give the best results. The production of cheese of the quality asked for by the British importer and retailer depends on just how well the dairy-farmer and cheesemaker perform their share of the work. With each doing his best the making of cheese of the right flavour and texture is easily possible.

CHECKING QUALITY OF FERTILIZERS.

MANY farmers may still be unaware that the Department of Agriculture is desirous of their assistance in checking the quality of the fertilizers on the market, by the forwarding of samples by them for analysis. No fee is charged for this work, and in the event of any deficiency being found an official sample of the fertilizer will be taken from the vendor's store by a departmental officer. This will enable legal proceedings to be taken should the results warrant it. For farmers' samples a portion of the fertilizer should be taken from each of a number of bags, and the portions thoroughly mixed together. Finally, a portion weighing about 1 lb. may be put into a clean, dry tin, and posted with the invoice certificate (or a copy of it), addressed to the "Agricultural Chemist, Dominion Laboratory, Wellington." It is essential that *the invoice certificate should accompany any sample sent*, or, if no certificate has been supplied, the name and address of the vendor and the brand of the fertilizer should be stated.

—*Chemistry Section*.

TESTING OF PUREBRED DAIRY COWS.

THE NEW ZEALAND CERTIFICATE-OF-RECORD RULES AND RETURNS.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

AFTER it had been decided, in 1913, that the Department of Agriculture should establish a system of authenticating the records of purebred dairy cows in New Zealand the next move was to formulate a set of rules governing the scheme. This at first thought may not appear a very difficult matter. We had, of course, closely studied what was being done in other countries, and with ideas based partly on the experience of others, partly original, we framed our first set of "Rules for the Semi-official Testing of Purebred Dairy Cows." This was in the spring of 1912. But each country, with its own peculiar conditions, has its own distinct requirements, and the first season's practice disclosed several omissions and irregularities, several rules which were either incomplete or which permitted an interpretation different from the intention, and even evasion. So, almost annually, it has been found advisable to make alterations and additions. Now, however, we feel that our rules are approaching that stage when they are as nearly "watertight" as it is possible to make them, and that nothing less than some marked change in general conditions, and impossible to foresee, can necessitate anything beyond minor amendments.

The rules governing the certificate-of-record* testing of purebred dairy cows are now widely known among New Zealand breeders of such stock, but for the information of other *Journal* readers who are interested in the subject, and as a general record, the latest issue of the rules (June, 1924) is here reprinted.

Occasional correspondence received at this office from breeders goes to show that some of the rules are not entirely understood. This being so, an explanation is given in this article of some of the more salient restrictions, and an indication of the object behind them. Further, in order that breeders may know something of the C.O.R. system from the point of view of the office a section treating with the handling of returns for C.O.R. cows has been included.

COMMENT ON THE RULES.

The first rule of special importance is No. 1 (*b*). The object of restricting the period between calving for commencement of test and calving prior to calving for test, in the case of cows four years old and over, was to prevent records being made under the advantage of a long rest as the result of cows being kept dry for the season preceding the season under test.

* The term "certificate of record" replaced the original "semi-official" in the year 1915. The latter term, however, is still often used informally by breeders, Press writers, &c.

The office of the Dairy Division is often put to considerable trouble through those desirous of testing cows not conforming to that section of Rule No. 2 (*a*) which provides that application shall be made at least a fortnight before due calving-date. There is more than one reason for the strict enforcement of this clause. First, advice prior to calving keeps us informed of what provision we shall require to make for carrying out the monthly visit. Second, it leaves time to adjust any irregularities in the making-out of the application form. Third, and most important, it enables us to keep a check on the date of calving for commencement of test; otherwise there would be nothing to prevent an unscrupulous breeder from entering a wrong date of calving prior to the true day, and recording fictitious weights for the period between the false and actual date, with the object, of course, that such milk-weights should give the cow a greater credit than would the yield for a similar period at the end of the season. By being in possession of the expected date of calving, however, an officer of the Department can make a check visit about that date in any case where such may be considered necessary.

The next rule which invites discussion is No. 3 (*a*). Breeders, despite this rule, sometimes complain because allowance is not made in the case of milk-weights unrecorded while cows under test are away from their usual headquarters. The point is that the C.O.R. milk-weights are a record of what the cow actually produces during the period she is on test, and not what she might have done under certain conditions. A cow which is away from her usual surroundings is usually adversely affected, and an average of her normal milk-weights would naturally give a distinct advantage. Apart from this, were there no rule on this point there would be nothing to prevent a dishonest breeder from purposely not recording milk-weights for a protracted period and claiming allowance under the excuse that he was unable to record weights or that his cow was affected through being away from the home farm.

Rule No. 3 (*f*): Without this restriction a milker might use a substance which would drip into the bucket and by chance find its way into the test-bottle and so enhance the butterfat content. The possibility, is, of course, remote, but this rule was considered necessary.

No. 4: It is desired that feeding of C.O.R. cows shall not include anything which will artificially improve the yield or test, thus placing a false estimate on the cow's ability.

No. 7 (*c*): The Dairy Division has met with instances of breeders wishing to refuse certificate on the ground that a certain record has not been up to expectation, thus lowering the average of their tested cows, or in some other way being considered an unsatisfactory advertisement. The Division's desire is not to authenticate a few outstanding performances, but rather to get as many cows as possible certificated, and consequently their male relatives backed by butterfat records. A certificate cannot be issued until the owner makes statutory declaration to all weights taken and all incidents of the test occurring while the cow was in his possession. We are then in a proper position to issue the certificate and publish the record.

No. 8: This rule is self-explanatory. All that need be said is that the calving restrictions are one of the strongest points of our testing system. They prevent abnormal performances as the result of cows being kept dry for a protracted period prior to test. Occasionally we have heard it said that fifteen months is too long a period to set between calvings, and that this should be reduced to a year, so as to conform to usual dairy-herd conditions. The main object behind this rule, however, is to bring about a longer average lactation period. Readers may be surprised to learn that for 151,214 ordinary herd cows on test in the 1923–24 season, and for which we have figures, the average cow milked less than eight months. That is to say, there were four months in which she was doing nothing by way of producing butterfat. We recognize that both the cow and the milker should have an annual rest, but ten months' work and two months' rest should be adequate. The primary motive in bringing in the C.O.R. testing scheme was to enable breeders to supply proven dams and sires from which the ordinary dairyman could draw for the purpose of building up his herd. It is reasonable to suppose that by developing a cow which can maintain her yield for twelve months, and by mating bulls from such dams with ordinary herd cows, the result should be a longer average milking-period, this meaning, of course, a distinct asset to the herd-owner and the country generally.

No. 9: The strong points of this rule are the restrictions to exactly twenty-four hours between the first and last milking of the testing officer's visit, and the testing separately of the samples. The object of the clause on stripping should be apparent. By leaving a cow unstripped at the preliminary milking of the visit the following milking from which a sample is taken would possibly benefit in both quantity and quality.

No. 10: It will be seen that the second portion of this rule provides that the 365-day milking-period for test shall commence not later than the day after calving. This, in conjunction with the restriction for subsequent calving, makes the test conditions conform more closely to usual daily herd practice. Originally it was made compulsory to commence the record on the day of calving. Obviously, however, a cow calving at early morning would have practically a full day's advantage over one calving in the evening, and the rule was altered in consequence.

No. 18: We have endeavoured as far as possible to prevent misrepresentation in the matter of advertising records of C.O.R. cows. Unfortunately, occasionally a breeder and sometimes an odd firm interested in the sale of purebred stock do not uphold the Dominion's reputation for accuracy and fair statement.

For the rest the rules will speak for themselves. We firmly believe that breeders as a whole realize the intention behind them, and, further, that they recognize the need for those rules which are restrictions and penalties. The Department aims at the highest possible degree of accuracy and of efficiency. A certificate easily gained is of no great value, but with the help of breeders and others interested we feel that the reliability of certificates based on the present C.O.R. rules can be maintained.

PREPARATION OF C.O.R. RETURNS.

Probably very few breeders who fill in and post to the office of the Dairy Division each month the milk-weights of their test cows are acquainted with the routine carried out before the results of those weights are returned to them in the form of monthly statements of yield. A brief outline of the procedure is as follows :—

The first step is to compare the figures on the form supplied by the testing breeder with the three and a half days' weights reported by the testing officer. Having ascertained that this matter is in order, the weights for the whole of the month are studied in conjunction with those for the testing officer's check milkings. This tells whether or not the officer has authenticated the weights recorded by the owner. The next move is to add the individual milk-weights, and thus check the daily totals entered by the owner. After this comes the checking of the total for the month. The average test is then entered on the weight-sheet, and the pounds of butterfat multiplied out.

A step must now be retraced and reference made to the test. When the testing officer's report on his monthly visit is received at the office all computations connected with that form are checked. The average test for each cow is then compared with the preceding tests with a view to detecting abnormalities. If the test is abnormally high or low the figuring of the return is held over pending receipt of the test results for the following month; or, if it is considered warranted, the testing officer is asked to make a special retest within the same month. This averaging and retesting causes some concern among breeders, many being inclined to consider that the Dairy Division has a habit of doing more cutting down than averaging up. Breeders may be assured that we set a percentage of variation, and whether there is a drop or a rise the case receives exactly the same treatment.

To return to the milk-weight sheet: After the butterfat is worked out, the figures representing the total milk-weights, the average test, and the butterfat for the month are transferred to a permanent record-card. The yield of milk and butterfat is brought forward to the end of the month under review and checked. The owner's monthly return is typed and checked, and the statement despatched, a note of the date of despatch being entered in a list. This, of course, is only one branch of the Dairy Division's clerical work.

Further reference may be made to variations in milk-weights. A special list is kept on which is entered the name of the breeder and cow in every case where the milk-weights have not been authenticated by the testing officer. If the breeder has been able to give the officer a reasonable explanation for decrease in milk-flow at the time of the officer's visit this explanation is taken into consideration. If the same cow is down in milk-weights at the time of the officer's visits for a protracted period a chart based on the daily weights is run out. The officer's check-weights are linked up with a direct line, and the result makes it clear whether or not the owner should receive a certificate.

Two charts are shown herewith, each based on an actual case. The days in milk are shown along the horizontal plane, as marked, while the daily milk-weights are plotted against the perpendicular scale. The dates of the testing officer's check visits are joined by a dotted line; the unbroken line joins the milk-weights as recorded by the

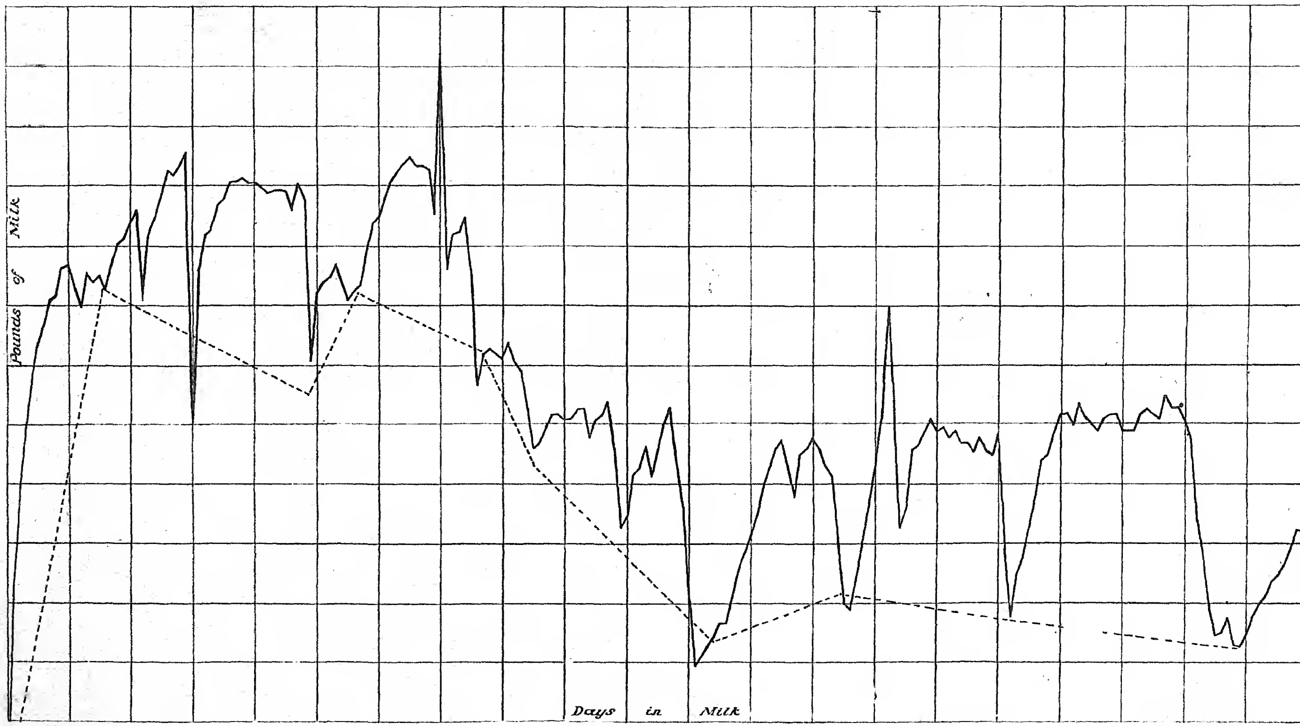


FIG. 1. CHART OF UNAUTHENTICATED DAILY MILK-WEIGHTS AS SUPPLIED BY OWNER OF A COW ON C.O.R. TEST.

In this case the test was discontinued and a certificate refused. For obvious reasons the milk-weight figures themselves are omitted from the reproduction. The unbroken line joins the owner's weights, the dotted line the testing officer's weights.

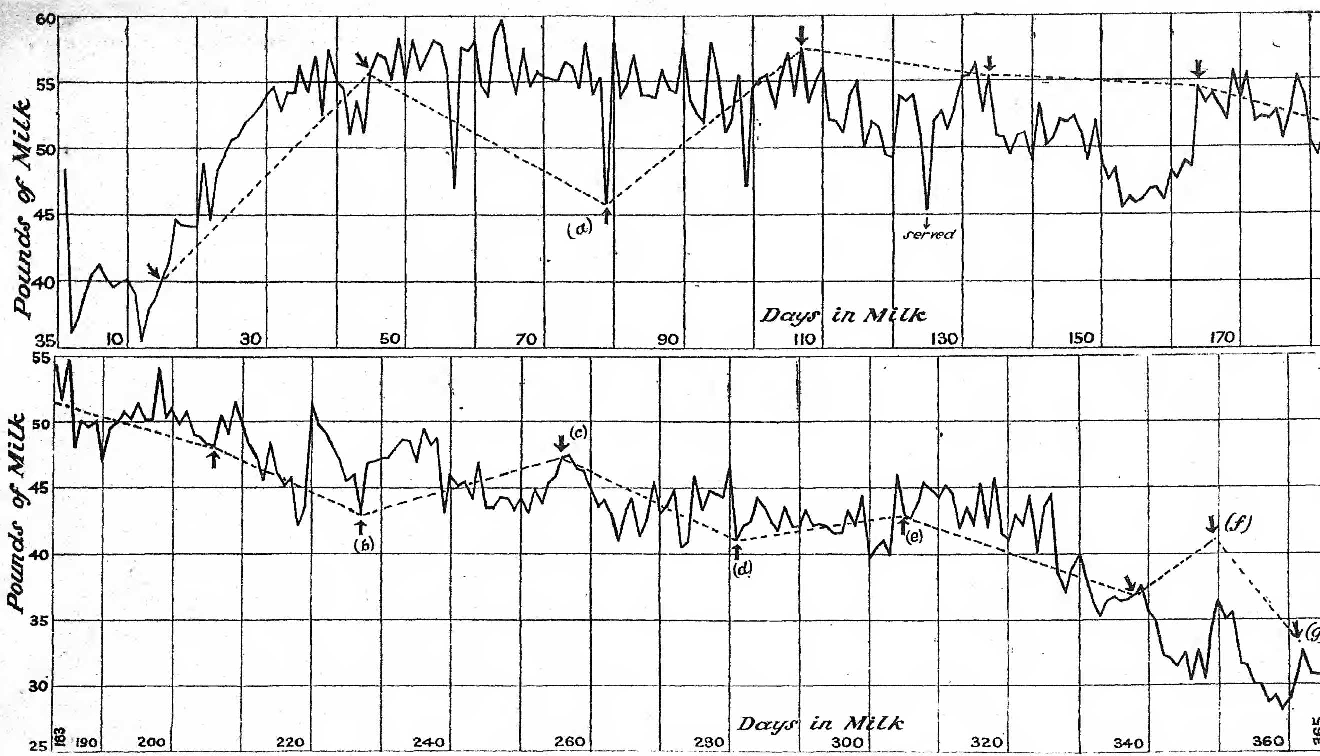


FIG. 2. GOOD EXAMPLE OF CLOSE AUTHENTICATION OF OWNER'S MILK-WEIGHTS BY TESTING OFFICER.

This chart covers the testing-period, in 1923-24, of Vivandiere, champion Jersey cow of New Zealand. The days of the tester's check weighings are indicated by an arrow-head point indicating check weight on day of inspection visit. Letters (*a*) to (*d*) signify that tester has reported to head office a satisfactory reason for decline in milk-weights on or just preceding date of his visit. As regards (*f*) and (*g*), where point indicating check weight on day of inspection visit is apart from main line of chart, in these cases tester happened to commence sampling at evening milking, and thus, while his figures would be for an evening and a morning milking, owner's weights as linked up by the unbroken line are on basis of normal day.

owner. Fig. 1 is based on the milk-weights (up to date of discontinuance of test) of a cow which was refused certificate. It is recognized that there are occasions when the testing officer chances to visit the farm just at a time when, through natural causes, a cow is down a little in weights. It is reasonable to expect, however, that the officer should, on a fair proportion of his visits, confirm the milk-yield as indicated by the owner's weights for the remainder of the month. In the Fig. 2 chart it will be observed that the line linking the testing officer's check passes practically midway through the lines joining the owner's daily milk-weights. Here and there a sudden temporary rise or fall will be noticed, but this is reasonable and natural. In Fig. 2, which is a common type of chart for cows whose yield has been unauthenticated, it will be seen how the dates of the officer's visits are the lowest points on the chart, and how the owner's weights gradually climb to their highest point midway between the officer's calls and gradually descend to the next visit.

The foregoing will serve to indicate how every care is taken and every endeavour made to place New Zealand certificates of record above reproach.

RULES FOR THE CERTIFICATE-OF-RECORD TESTING OF PUREBRED DAIRY COWS.

1. (*a.*) The Dairy Division of the Department of Agriculture will assist in the certificate-of-record testing of only such cows as are duly and properly registered in the New Zealand herd-book of the breed to which they belong.

(*b.*) No four-year-old or mature cow shall be eligible for entry unless she shall have dropped a living or mature calf within 455 days prior to the calving for commencement of test.

Application for Testing.

2. It shall be the duty of every owner offering a cow for test—

(*a.*) To forward to the secretary of his breeders' association, at least a fortnight before due calving-date, and on a form to be supplied by the Department, an application properly filled in with the particulars required by such form: Provided that inability or failure to furnish the exact age shall not necessarily be a bar to entry; but all cows the age of which cannot be so ascertained may be required to qualify as mature cows, or as cows of such age as the Director of the Dairy Division, having regard to all the circumstances of the case, shall deem just. If he so desires, the Director shall be supplied by the owner with a veterinary certificate regarding age.

(*b.*) To forward payment of testing fees to the Director of the Dairy Division, Wellington, before the cow or cows entered for test commence their period of test.

Recording and forwarding of Milk-weights.

3. (*a.*) The owner, or his agent, shall weigh and record the weight of each and every milking of the cow during her testing-period, and it is hereby expressly provided that this shall include all milkings during the time the cow may be attending any show or otherwise away from the owner's farm. Record blanks for this purpose shall be supplied by the Department.

(*b.*) The owner shall forward to the Director of the Dairy Division, Wellington, within one week after the end of each month, a legible copy in ink of this record.

(*c.*) The owner shall not fill in any space occasioned by any weighing being inadvertently or otherwise missed, but when forwarding the monthly weights shall include an explanation of such omission, and the Director of the Dairy Division shall determine what allowance, if any, shall be made.

Scales.—Milking-machines.—Lubricant for Milker's Hands.

(*d.*) The scales used shall meet with the approval of the Director of the Dairy Division.

(*e.*) Milking-machines may not be used on the releaser principle.

(*f.*) Where the milker milks with dry hands—*i.e.*, without using milk as a lubricant—the use of vaseline, petroleum-jelly, or other such substance may be permitted, provided that in the opinion of the testing officer the quantity so used is not excessive. If milk be used for this purpose no other lubricant shall be permitted.

Milking-hours.

(*g.*) It shall be the duty of an owner, at the request of the Director of the Dairy Division, to so arrange his milking-hours that the testing officer may take the check weights and samples on the same dates as for one or more breeders in the vicinity.

Feeding.

4. The owner shall see that no milk or milk product is fed to any cow on certificate-of-record test, and, excepting as remedies in case of sickness, no condiments, condition-powders, or drugs shall be given.

Dates of Service.

5. The owner shall indicate on the first monthly weight-sheet forwarded the Department after service the date of the first and any subsequent service during the testing-period.

Notification of Calving subsequent to Test.

6. The owner shall, on the day of calving subsequent to test, notify the Director of the Dairy Division of such calving. This rule shall also apply to premature calving.

Declaration.—Change of Ownership during Testing-period.

7. (*a.*) It shall be the duty of the owner after the cow has calved subsequent to test to make declaration, on a form to be supplied for that purpose by the Department, of the weights of milk given by such cow in each month or part thereof during such testing-period, and of her name, registered number, age, date of calving prior to test, date of calving for period of testing, date of service, and date of calving subsequent to test.

(*b.*) Should a cow under this test be sold, and the purchaser desire to continue such test, it shall be the duty of the vendor to forward to the Director of the Dairy Division a declaration indicating all relevant particulars required by the form of declaration referred to in (*a*) above, and which have occurred prior to the time of transfer of ownership.

(*c.*) In all cases declaration must be completed and returned to the Director of the Dairy Division within thirty days of date of despatch by the Dairy Division. If the owner fails to comply with this rule the Department may refuse acceptance of further applications.

Qualifications relating to Dates of Calving.—Premature Calving.

8. Every cow, in order to qualify for a certificate, must drop a mature calf within 455 days after the calving for commencement of test: Provided that, in the case of a cow aborting or calving prematurely within this 455-days period, the cow must have been served so as to drop a mature calf within 455 days. Premature calving shall terminate the testing-period. (The period of gestation shall be deemed to be 282 days.) It is also provided that prior to the date of abortion the Director of the Dairy Division must have been advised by the owner or his agent of the date of service.

Rights and Duties of Testing Officer.

9. The testing officer of the Department shall have right at any time to visit the farm on which the cow is under test, and he shall have the right to perusal of milk-weights on demand. He shall make his testing-visits as nearly as possible every month. For the first milking during his visit he shall take the weight but no sample, and he shall take the time at which the milking is made. For the following two milkings (or three, according as the cow is milked twice or three

times daily) he shall take check weights and samples, and the last milking shall be twenty-four hours later than the first milking of his visit. Each milking shall be tested separately, and the samples shall be kept under lock and key or sealed until tested. They shall be tested by a departmental officer. No cow shall be tested when her yield is less than 4 lb. of milk per day. No cow shall be tested until a period of at least ninety-six hours has elapsed between calving and the taking of the first sample.

Stripping.

The testing officer shall try the cow's teats after the preliminary milking to see that such cow has been stripped clean by the milker, and he shall have the right so to do for any cow on test at any milking at time of his visit.

Abnormal Tests.—Method of calculating Production.

10. The percentage of butterfat for the month shall be that as calculated for the day's test from the total weight of milk and butterfat produced during the twenty-four hours. Should the average per cent. fat found in the milk during any monthly test be considered abnormal by the Director of the Dairy Division, he may reject that test and use the average per cent. fat obtained from the preceding and succeeding months as a basis for computation of the fat-production for that month.

The monthly fat-production of a cow shall be calculated by figuring the total milk credit for the month at the average test for the day obtained by the testing officer. The annual production shall be calculated by totalling the production of pounds of milk and butterfat for each month or part thereof during one lactation period, and not exceeding 365 days, commencing not later than the day after calving. The first return of monthly milk-weights shall be accepted as indicating whether the 365-days period commences on the day of calving or the day after calving.

Discontinuing Test.

11. The testing of a cow may be discontinued by the Department and without refund of testing fee, provided—

(*a*.) That such cow be not pregnant sufficiently early to drop a mature calf in time to qualify for a certificate on a 282-day gestation period;

(*b*.) That after 150 days on test she has produced less than one-half her requirement for qualification for C.O.R., or is, in the opinion of the Director of the Dairy Division, unlikely to produce the minimum amount of butterfat required for certificate from a cow of her age;

(*c*.) That in the opinion of the Director of the Dairy Division the milk-weights as forwarded to this office have not been authenticated;

(*d*.) That in the opinion of the Director of the Dairy Division the testing breeder has not afforded the testing officer all reasonable facility for carrying out his duties;

(*e*.) That any of the duties prescribed by these rules for the owner of a cow on test have been contravened or not given effect to.

The Department may refund the testing fee and discontinue the test for any owner who, on request by the Director of the Dairy Division, declines to arrange his milking-hours so that a testing officer may visit one or more other testing breeders on the same dates.

Acceptance of Application.

12. The Director of the Dairy Division may decline acceptance of application in any case where such testing cannot conveniently be undertaken by the existing staff of testing officers, and he may decline acceptance of application from any owner who at any time has been refused certificates on account of breach of rules, or on account of the recorded milk-weights not having been authenticated, or the testing of whose cows has been discontinued on account of breach of these rules.

Testing Fees.

13. For the first cow or heifer to be tested on one farm and commencing test after the 1st April of each year the fee shall be ten guineas, and for each subsequent cow or heifer commencing test within that same year the fee shall be three guineas: Provided that a period of not more than six months shall elapse between the date of calving of the first and last cow or heifer entered. This shall be the charge for the work done during one lactation period only, and not exceeding 365 days, commencing not later than the day after calving.

In the case of transfer of ownership during the testing-period the testing fee shall be as follows: If the cow which is transferred during her testing-period be the only cow on test at the farm of the vendor, no further fee shall be payable If the purchaser of such cow has other cows on test at the time of transfer, no further fee shall be payable, provided the completion of the testing of any purchased cow does not continue beyond the last test for any cow then on test at the farm of the purchaser. In all other cases the fee payable shall be at the discretion of the Director of the Dairy Division.

First-class Certificate.

14. The owner of every heifer or cow which shall have produced the minimum pounds of butterfat required by an animal of her age and class as determined by Schedule A appended shall, on compliance with all the rules hereinbefore contained, be entitled to a first-class certificate.

Second-class Certificate.

15. A cow or heifer duly accepted for test on the above rules shall be deemed to have qualified for a second-class certificate provided—

(*a*.) That she produced the butterfat requirement for her age ;
(*b*.) That she dropped a mature calf during the period between the 456th and 485th days, inclusive, after commencement of test ;
(*c*.) That in the opinion of the Director of the Dairy Division the owner of the cow or heifer has done all within reason to have such cow or heifer qualify on subsequent calving for a first-class certificate—*i.e.*, within 455 days after calving for commencement of test.

Re-entry for Second-class Certificate.

16. A cow qualifying for a second-class certificate shall be eligible for re-entry for a second-class certificate during the following lactation period, and shall be granted such certificate, provided that, with the exception of the time allowed for previous calving, the incidents of the test shall conform to the requirements of a first-class certificate.

Non-issue or Cancellation of Certificate.—Issue of Certificate.

17. (*a*.) No certificate, either first or second class, shall be granted if in the opinion of the Director of the Dairy Division the milk-weights as forwarded by the owner have not been authenticated, and a certificate may be cancelled and the record expunged if it subsequently be found that in the opinion of the Director of the Dairy Division, and of a majority of the executive of the breeders' association of which the owner is or was a member, the record was not made in accordance with the rules.

(*b*.) In every case where a cow qualifies for certificate of record such certificate shall be issued and particulars entered in the records of the Department, and such particulars shall also be forwarded to the secretary of the breeders' association concerned.

Advertising of Records.

18. Whenever publishing or advertising the record of any cow which is on test, or which has been on test, the particulars used shall, unless otherwise stated, be strictly in accordance with official statement issued by the Director of the Dairy Division. No figures applying to a record on which a cow has been refused certificate, or whose testing has been discontinued by the Department, shall in any case be used ; or, if any figures for such cows be in print at the time of notice of discontinuance by the Department, such figures shall immediately be withdrawn.

In the event of sale, either privately or by public auction, of any cow whose testing has been discontinued by the Department, or whose certificate has been cancelled, the owner or his agent shall, before offering such animal for sale, announce that the figures supplied by the Dairy Division and appearing in the catalogue, or in any way previously advertised, are void.

Breeders owning a cow with a second-class certificate shall, whenever advertising or publishing the record, use the description "II Class C.O.R." immediately preceding the butterfat figures for such record—thus, "II Class C.O.R., 555 lb. fat." Any breeder failing to do this may be refused further certificates.

Any breeder or owner failing to comply with the foregoing may be refused certificates for any cows which may be on test at the time of breach of these regulations, and may also be debarred the right of entering further cows for test.

Interpretation of Rules.

19. In the event of any question arising as to the administration of the certificate-of-record test, or as to the interpretation of the rules governing the same, the Director of the Dairy Division shall consider the case, and his decision shall be final.

SCHEDULE A. CERTIFICATE-OF-RECORD TESTING OF REGISTERED PUREBRED DAIRY COWS.

CLASSES.

The classes for certificate-of-record cows as agreed upon by the respective breeders' associations are as follows:—

Jerseys.

Cows 2 years 92 days and under shall be classed as junior two-year-olds.
Cows 2 years 93 days and under 3 years shall be classed as senior two-year-olds.
Cows 3 years and under 4 years shall be classed as three-year-olds.
Cows 4 years and under 5 years shall be classed as four-year-olds.
Cows 5 years old and over shall be classed as mature.

Friesians and Milking Shorthorns.

Cows 2 years 183 days and under shall be classed as junior two-year-olds.
Cows 2 years 184 days and under 3 years shall be classed as senior two-year-olds.
Cows 3 years to 3 years 183 days shall be classed as junior three-year-olds.
Cows 3 years 184 days and under 4 years shall be classed as senior three-year-olds.
Cows 4 years to 4 years 183 days shall be classed as junior four-year-olds.
Cows 4 years 184 days and under 5 years shall be classed as senior four-year-olds.
Cows 5 years old and over shall be classed as mature.

Ayrshires and Red Polls.

Cows under 3 years old shall be classed as two-year-olds.
Cows 3 years and under 4 years shall be classed as three-year-olds.
Cows 4 years and under 5 years shall be classed as four-year-olds.
Cows 5 years old and over shall be classed as mature.

YIELD OF BUTTERFAT REQUIRED FOR CERTIFICATE.

A heifer starting a test on the day she is two years old or before that date shall be required to give the amount of butterfat required of a two-year-old. For every day she is over two years old she shall be required to give 0·1 lb. of fat more than her requirement as a two-year-old. This daily increase shall continue until the cow is five years old, when she shall be required to give the minimum for a mature cow. Thus:—

If two years old at the commencement of the test, 240·5 lb. fat.
If three years old at the commencement of the test, 277·0 lb. fat.
If four years old at the commencement of the test, 313·5 lb. fat.
If five years old at the commencement of the test, 350·0 lb. fat.

REMINDERS TO BREEDERS WITH COWS ON CERTIFICATE-OF-RECORD TEST.

Preserving Monthly Milk-weights.

Loss of monthly milk-weights in the post sometimes occurs. Breeders are strongly advised to retain a copy of all milk-weights forwarded us until they receive from us their returns for the month. This will assist in protecting the cow's record against loss of credit.

Breeders should communicate with the Director of the Dairy Division if monthly statement of yield is not to hand within the month following that for which weights were taken.

Recording of Milk-weights at Shows.

Breeders who are exhibiting at shows cows which are on C.O.R. test should be careful to see that all milkings at the shows, or on the way to or from the shows, are weighed and recorded as usual. The Department does not promise in any way to take notice of any milk-weights which are not duly recorded on such occasions.

The Director of the Dairy Division would take it as a favour if breeders would advise him of the dates on which they propose to show their cows, so that he can make arrangements with the testing officer for the monthly test.

Notification of Dates of Service.

It is in the interests of breeders to see that date of first and any subsequent service is indicated on the first monthly weight-sheet forwarded the Director of the Dairy Division after service.

If a cow aborts after having produced her butterfat requirement a certificate may be granted, provided the Director of the Dairy Division has previously received advice of the date of satisfactory effective service.

Notification of Calving-dates subsequent to Test.

Notification of calving-dates after testing-period should be made by telegram if within a fortnight of time-limit (455 days after commencement of test for first-class certificate, or 485 days for second-class certificate), otherwise notice by letter is sufficient. The onus of notification of calving-dates subsequent to test rests with the owner.

For purposes of record the Director of the Dairy Division will be pleased to receive notification of all calving-dates, whether beyond the last day for certificate or not.

FULLER'S TEAZLES FOR WOOLLEN-MILLS.

At the present time all the supply of teazles used by the local woollen-mills in dressing certain classes of woollen goods is imported from Europe. It appears that when the Mosgiel Company's works were established many years ago seed of the fuller's teazle (*Dipsacus fullonum*) was imported, and the plant grown for a while on the Taieri Plain, but its cultivation was not maintained. At the suggestion of Hon. G. M. Thomson, M.L.C., of Dunedin, the Department of Agriculture procured some seed from England, with a view to testing its economic production. The seed was sown in the spring of 1923 in the grounds of the Department's depot at Christchurch, and, the plant being a biennial, the crop ripened in the summer of 1924–25. The following brief report by Mr. F. E. Ward, Instructor in Agriculture for Canterbury, gives information of interest :—

"Some plants remained in the original rows in which they were sown ; others were transplanted into rows 2 ft. apart and 1 ft. between the plants. The small plants transplanted well, and all grew to a height of about 6 ft. A large number of teazles set, about half of which were too small for commercial size. From counts taken from a few plants, I estimate that anything from 100,000 to 200,000 commercial teazles could be grown per acre. The Kaiapoi Woollen Company imported last year over 71,000 teazles, the price being £2 15s. per 1,000 in England and £3 12s. per 1,000 landed here. These were procured from a Leeds agency, but, like the bulk of commercial teazles, were grown in southern France. Blankets, rugs, and tweeds are the goods on which teazles are mainly used. Four machines are installed at Kaiapoi, and on each of these there are 90 teazles in a row, and about 24 rows, or, in all, over 2,000 teazles on a machine. As there are ten mills in operation in the Dominion the annual consumption must be large. The teazles grown at the Christchurch depot compare favourably with the imported article, though they were on this occasion allowed to get rather too dry before gathering. Undersized heads are of no use, but larger ones can be cut if they are of about the same diameter. It would appear that teazles could be profitably grown in New Zealand, but the country's requirements could be supplied by one or two growers."

Mr. Thomson is further interesting himself in the matter, holding that even small matters of this kind merit attention in the Dominion's economic interest.

PASTURE TOP-DRESSING IN CANTERBURY.

EXPERIMENTS AT SOCKBURN AND TAI TAPU, 1923 and 1924.

F. E. WARD, H.D.A., Instructor in Agriculture, and A. W. HUDSON, B.Agr., B.Sc., Assistant Instructor in Agriculture, Christchurch.

In the more climatically favourable districts of New Zealand top-dressing of pastures has been for many years an established practice, but under Canterbury conditions of light rainfall and short-rotation pastures top-dressing has not generally been practised. In co-operation with the Canterbury Soils Improvement Committee, carefully planned experiments were arranged in 1923, and were continued by the Fields Division in 1924. The results of those undertaken in 1923 are now recorded, one experiment being continued into the second year.

MANURES USED.

The manures used were as follows, the quantity stated being per acre in each case:—

Season 1923: (1) Superphosphate (42-44), 2 cwt.; (2) superphosphate (42-44), 1½ cwt., plus dried blood, ½ cwt.; (3) basic super (40-43), 2 cwt.; (4) basic super (40-43), 1½ cwt., plus dried blood, ½ cwt.

Season 1924: As in the case of the manures used in the wheat manurial experiments, results of which were published in the April *Journal*, it was decided to apply equal amounts of phosphate (2 cwt.) on all plots, the blood being an addition on those plots where it was used. The object in the selection of the manures was to test soluble phosphate (super) against the less soluble phosphate (basic super), and to note the effect of dried blood used in conjunction with these phosphates.

SEASON 1923 EXPERIMENTS.

(1.) *On Farm of T. Bloor, Sockburn.*

The soil of this area is a rich silty loam. The paddock was sown down in September, 1921, with a mixture of 30 lb. perennial rye-grass and 5 lb. cow-grass. Hay was taken off in 1922, the paddock being then grazed until closed in October, 1923, for the top-dressing experiment. The manures were applied on 6th September, 1923, and the plots weighed early in December. Each of the plots was four widths of the drill and the length of the paddock. The four manures mentioned and a control plot (no manure) constituted a series. There were four series, giving twenty strips in all.

On certain portions of the field distinct differences between manured plots and controls could be observed before harvest, while on other parts no differences in growth were discernible.

Six areas of $\frac{1}{259}$ acre were weighed on each plot, giving twenty-four weighings in each treatment. The ratio of hay weight to green weight was not determined, but, in light of estimations made this year, it may safely be assumed that this would be about 1 to 3, and for purposes of evaluation of increases the hay weight is regarded as being one-third of the green weight. The table which follows shows the results obtained.

Table 1.—Result of Top-dressings on Farm of T. Bloor, Sockburn.

Treatment.	Yield of Hay per Acre.	Increase due to Manure.	Value of Increase at £5 per Ton.	Cost of Manure per Acre.	Net Profit per Acre.
	Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Super	1·29	0·13	*	*	*
Super and blood ..	1·38	0·22	1 2 0	0 17 5	0 4 7
Basic super	1·38	0·22	1 2 0	0 13 6	0 8 6
Basic super and blood	1·32	0·16	0 16 0	0 16 8	Loss 8d.
Control	1·16	..	..	..	..

* Increase not significant. The application of the statistical method enables the investigator to estimate the chances of any differences which occur being real and due to the treatment and not to chance variation. When a difference occurs, and the odds in favour of such difference being a real one are greater than 30 to 1, the difference is here said to be "significant." If a difference occurs with chances of less than 30 to 1 in its favour, such a difference is spoken of as being "not significant." To simplify this article the odds are omitted, and differences which are "not significant" are noted as such. Any non-significant difference must be regarded as due to mere chance variation in the crop, or else an insufficient number of weighings has been taken to reduce the "probable error" sufficiently to permit the difference being measured with certainty, in which case the result must be regarded as showing no difference.

The results as given in the table show that only a small margin of profit can be claimed from the use of two of the manures. These results, however, only record the effect on three months' growth, and if the increase in hay pays for the manure it is highly probable that the benefits will be quite considerable ultimately.

A study of the weighings taken twelve months later in W. G. Macartney's experiment showed a very definite belated effect from the manures of 1923 application. A consideration of the 1924 experiment on this farm and shown later herein indicates that the application of these manures has paid handsomely. The lateness of sowing, coupled with the extremely dry conditions which prevailed during the growth of the hay crop, no doubt limited the effect of the fertilizers on the early growth.

(2.) *Experiment on Farm of W. G. Macartney, Tai Tapu.*

The soil of this area varies from a clayey loam at one end to a silty loam at the other. Sowing of the pasture took place in the autumn of 1922, the mixture consisting of 20 lb. Italian rye-grass, 20 lb. perennial rye-grass, and 6 lb. cow-grass per acre. The manures for the experiment were applied early in September, 1923, and the plots weighed in December. The lay-out of the plots was similar to that in T. Bloor's experiment, and may be seen in the accompanying diagram (Fig. 1—season 1923 plots).

In this experiment ten areas of $\frac{1}{250}$ acre each were weighed in each strip, giving forty weighings in each treatment. Since the differences in yield which occurred are in no case significant, only the green weights per acre are shown. In this case, however, the chances of super being better than control are 22 to 1. We do not accept these odds as certainty, but regard them as indicating a good chance of the difference being a real one.

The yields on the different treatments were as follows, the amounts stated being green weight per acre: Control, 2·83 tons; super, 3·26 tons; super and blood, 2·94 tons; basic super, 2·73 tons; basic super and blood, 2·83 tons.

These figures will be found very interesting when the reader has perused the results of the weighings made on this area in 1924. From the 1923 figures, however, it must be concluded that in the first hay crop the application of the manures did not pay. The appearance of the paddock later in the season, when the subsequent crop of red clover was growing for seed, showed that the manures were having some effect. Mr. Macartney was of the opinion that distinct differences could be seen in places.

On 4th August, 1924, the field was visited by the writers. A casual examination revealed the fact that certain plots had a much greater amount of clover stubble on them than the others. These plots proved to be controls, and so distinct was the difference that the edge of each control could be seen from one end of the paddock to the other. A closer examination showed a much better sole of rye-grass on the manured areas; the grass looked much darker and more vigorous. No difference could be detected between the clover contents of the plots. The extra stubble on the control areas shows a decidedly smaller amount of grazing on these plots, indicating in all probability less growth and a lower palatability. Undoubtably this is an important factor, and one the value of which cannot be readily determined.

Mr. Macartney having signified his willingness to give the field further trial, it was then decided to repeat the experiment as described below:—

SEASON 1924 EXPERIMENT ON FARM OF W. G. MACARTNEY.

As indicated previously, a crop of red clover for seed was taken off the area after the hay crop of 1923. In 1924 the main constituents of the pasture were perennial rye-grass, suckling-clover, red clover, and white clover; and in patches creeping-fog and black medick had made their appearance. The plan of experiment shown in Fig. 1 was decided upon in order to try and ascertain the following points: (1) The belated effect of the 1923 dressing on the yield of 1924; (2) the effect of dressing for two consecutive years with the same manures; (3) the effect of the 1924 dressings on the controls of 1923; (4) the effect of the 1924 dressing on top of that of 1923. As will be seen, the dressings of 1924 were made across those of 1923.

The manures were applied on 20th August, and the paddock was closed for the hay crop on that date. On 23rd October the plots were closely examined, but no differences between manured plots and controls could be distinguished. At this stage it appeared as though the results would be a repetition of those of the previous year.

The area was cut and weighings made on 2nd and 3rd December, at which time what appeared to be slight differences could be detected in places only. This is a noteworthy fact, and the results go to show that differences may be present without being easily seen.

METHOD OF MEASURING, CUTTING, AND WEIGHING PLOTS.

The reader is referred to the plan (Fig. 1) where sighting-poles are indicated by crosses. For measuring purposes the poles were placed on a line which marked the end limits of the plots to be weighed. It will be seen that by standing anywhere on this line (for example, line AB), and sighting in either direction (according to whether the

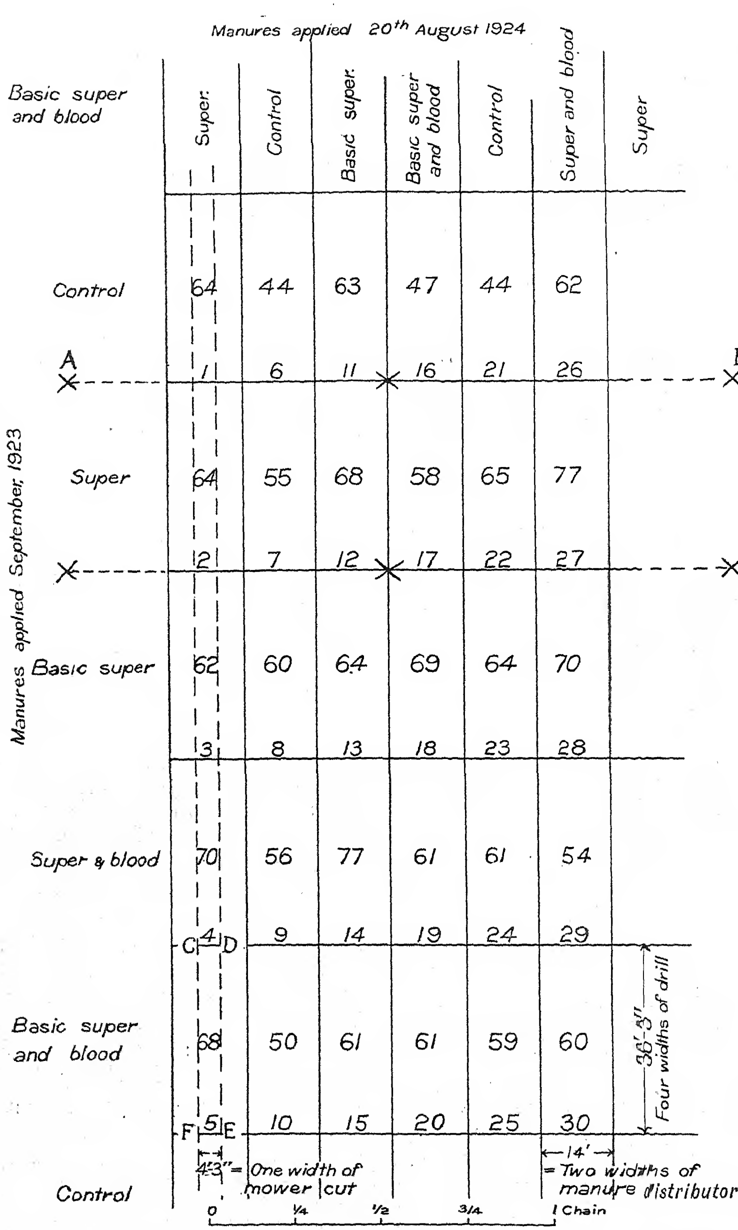


FIG. I. PLAN OF ONE-SIXTEENTH OF TOTAL AREA OF PASTURE TOP-DRESSING EXPERIMENT ON FARM OF W. G. MACARTNEY, TAI TAPU.

The size of an individual weighed plot is 36 ft. 3 in. by 4 ft. 3 in. = $\frac{1}{283}$ acre, and is indicated by the rectangle CDEF. The total number of areas weighed was 480. The figures 1 to 30 at the bottom of each rectangle are simply plot

observer is one side or the other of the centre pole), it is possible to determine the end limits of the plot without measuring during the weighing. Every plot was marked out as indicated, and the area of each was $\frac{1}{288}$ acre.

By cutting through the crop at right angles to the line AB, and along the junction of the two middle plots, four sides were available on which to work. This arrangement is important, as it enables the farmer who is co-operating in the experiment to carry on his harvesting operations with as little delay as possible. In the experiment under review only two sides were worked, as the weighing staff was small, and the field contained an ample area outside the experimental portion on which cutting could be done while weighings were in operation. A straight cut was made along the edge of the first plot to be weighed, and cutting proceeded in the usual way, except that the mower ran empty along the headlands. As soon as the cut nearest the middle of each of the strips of 1924 dressing was reached, particular care was taken to make the cut a constant width throughout its length. The accuracy with which such a cut could be made was remarkable, the width rarely varying by more than 1 in. either side of the average width of 4 ft. 3 in.

As soon as the cut was started, the weighers followed the machine. The grass on each plot C, D, E, F (see plan) was raked to the middle, rolled into a sheet, and weighed as shown in Fig. 2. No strip was cut until the previously cut one had been weighed. This method ensured the material being weighed under as uniform conditions as were practicable and before drying out took place.

METHOD OF ESTIMATING PROPORTION OF HAY WEIGHT TO GREEN WEIGHT.

Ten samples, each of 10 lb., were weighed to the nearest ounce immediately they were cut. The sampling was done indiscriminately so that a fair average could be obtained. These samples were dried separately under as uniform conditions as possible, and when they were considered to be as dry if not drier than ordinary hay each was again carefully weighed. The average percentage of hay was then calculated, the figure obtained being $36{\cdot}8 \pm 0{\cdot}73$ per cent. The figure following the $\pm$ sign is the "probable error," and may be regarded as a measure of the reliability of the average with which it

---

numbers which are referred to when discussing the tables of results in the article. The figures in the middle of each rectangle are actual green weights per plot of a typical section of the field, given in order to indicate the variation which occurs among plots of similar treatment; hence the necessity for a large number of weighings.

The plots running across the page are those of the 1923 treatment, and those running from top to bottom are the 1924 treatment. It will be seen that certain plots (for example, where a control of 1924 crosses a control of 1923) have had no manure at all during the two years. These plots are referred to as "double controls," and Nos. 6 and 21 are examples. Other plots which have had treatment with the same manure for the two seasons, as where super 1924 crosses super 1923 (for example, No. 2), or where basic super 1924 crosses basic super 1923 (for example, No. 13), are referred to as "double super" or "double basic super" respectively. In every case comparisons have been made between plots situated alongside one another or separated only by one intervening plot.

The crosses (×) indicate the position of sighting-poles, the use of which obviated the necessity of measuring every plot during weighing.

is associated. By reference to a table of odds we know that it is 13 to 1 (here accepted as practical certainty) against any other similar set of samples varying from the one already obtained, by more than 2·7 times the probable error. It can be said, therefore, that the percentage of hay weight is 36·8 and certainly not less than 34·88—that is, $36{\cdot}8 - (0{\cdot}73 \times 2{\cdot}7)$ of the green weight.

For purposes of evaluating the increases we have taken the percentages of hay as being 34·8, this allowing a margin of safety. The hay weights as calculated are shown in Tables 2 to 5.

Table 2.—Belated Effect of 1923 Dressings on Yields in 1924.

NOTES.—The manurial treatments are compared with double controls (*i.e.*, plots which have received no manure at all during the two years) or with one another. For example, in the case of super, Plot 7 is compared with Plot 6 (see plan), and Plot 22 with Plot 21, Plots 7 and 22 having been dressed with super only in 1923, and Plots 6 and 21 having received no manure at all. The number of plots compared is given in the second column; for example, the yields and differences between super and control are estimated from thirty-two paired plots, &c.

Hints on reading this and following tables: When a control is shown between two manures both manures are compared with the same controls. When the manures are compared with one another directly it will be noticed that in some cases the yield for a certain manure is slightly different in one place from that shown in another. This is due to the fact that a different number of plots has been used to estimate the average difference in each case. For instance, where super and blood in Table 2 is compared with control, the yield and difference are estimated from twenty-four paired plots. Where, however, super and blood is compared directly with basic super and blood, and with super, thirty-two paired plots are taken. The number of plots compared is governed by the proximity to one another of such plots. Compared plots are bracketed with one another in the tables.

Treatment.	Number of Plots compared.	Yield of Hay per Acre.	Difference in Hay per Acre.	Value of Difference at £5 per Ton.	Cost of Manure per Acre at Country Station.*	Net Profit per Acre.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Super	32	2·635	0·550	2 15 1	0 14 6	2 0 7
Control	32	2·085	..	..	..	..
Basic super	32	2·515	0·430	2 13 0	0 13 6	1 19 6
Basic super and blood..	24	2·396	0·279	1 7 11	0 16 8	0 11 3
Control	24	2·117	..	..	..	..
Super and blood ..	24	2·430	0·313	1 11 4	0 17 5	0 13 11
Super	32	2·635	†	†	†	..
Basic super	32	2·515				
Super and blood ..	32	2·513	†	†	†	..
Basic super and blood..	32	2·516				
Super	32	2·635	†	†	†	..
Super and blood ..	32	2·513				
Basic super	32	2·515	†	†	†	..
Basic super and blood..	32	2·516				

* Super (42–44), £7 5s. per ton; basic super (40–43), £6 15s. per ton; dried blood (12 per cent. nitrogen), 13s. per hundredweight. † Difference not significant.

This table shows that the manures applied in 1923 gave a sufficient increase in yield in the 1924 hay crop alone to leave a profit. When it is borne in mind that an increased growth must have resulted during the greater part of the time since the application of the manure there need be no doubt regarding the total increase in yield.

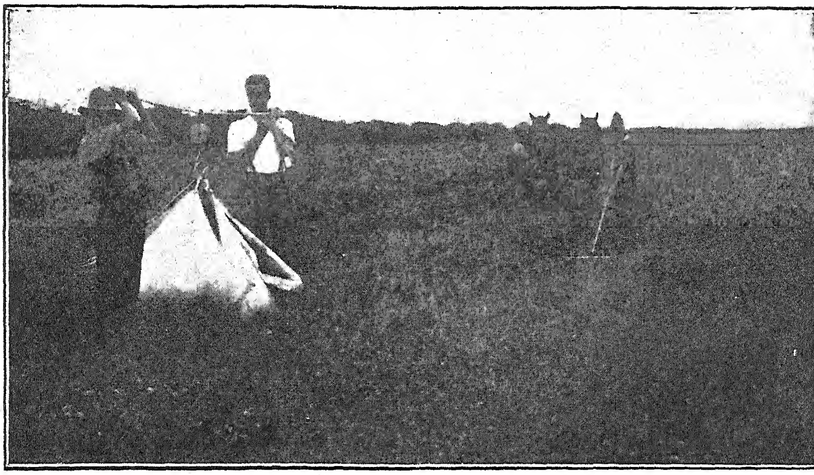


FIG. 2. ILLUSTRATING METHOD OF WEIGHING PLOTS.

In this case the crop was light, and a strip was cut down the length of each plot and through the standing crop without undue damage. This method is easier if the crop is not too heavy, the mower being engaged in cutting the remaining portion of the plots when waiting for the weighing operations to catch it up.

Table 3.—Yields from Double Manures compared with Double Controls, and Double Manures compared with one another.

(For explanation of terms " double " manure, &c., see note on plan. Example of comparison: Double super, Plot 2, compared with double control, Plot 6, as shown on plan.)

Treatment.	Number of Plots compared.	Yield of Hay per Acre.	Difference in Hay per Acre.	Value of Difference at £5 per Ton.	Cost of Manure per Acre at Country Station.*	Net Profit per Acre.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Double super ..	16	2·954	0·873	4 17 3	1 9 0	3 8 3
Double control ..	16	2·081	..	..	..	..
Double basic super ..	16	2·878	0·797	3 19 8	1 7 0	2 12 8
Double basic super and blood	12	2·680	0·535	2 13 6	1 16 8	0 16 10
Double control ..	12	2·145	..	..	..	..
Double super and blood	16	2·803	0·662	3 6 2	1 18 5	1 7 9
Double control ..	16	2·141	..	..	..	..
Double super ..	12	2·965	†	†	†	..
Double super and blood	12	2·863				
Double basic super ..	16	2·877	†	†	†	..
Double basic super and blood	16	2·814				
Double super ..	16	2·954	†	†	†	..
Double basic super ..	16	2·877				

* Total cost of both applications, 1923 and 1924. † Difference not significant.

The increases due to all the manures shown in this table are highly significant and paying ones, but the differences between the yields of the manured plots themselves are not significant. In this case the cost of the manure for the two years has been more than paid for by the increase in only one crop of hay. When it is considered that this crop represents only about one-half of the total growth of grass for the 1924–25 season the results speak for themselves.

Table 4.—Yields from Manures applied in 1924 compared with Double Controls.

NOTE.—In this case, where the dressings applied in 1924 have crossed a control plot of 1923, these are plots with only one dressing of manure. Comparisons are made between these plots and those having no manure (double controls), or between the manures themselves. Examples—(*a*.) Super, 1924 (Plot 1 in plan), is compared with its neighbouring double control (Plot 6 in plan), and so on. (*b*.) Basic super, 1924 (Plot 11 in plan), is compared with basic super and blood (Plot 16 in plan).

Treatment.	Number of Plots compared.	Yield of Hay per Acre.	Difference in Hay per Acre.	Value of Difference at £5 per Ton.	Cost of Manure per Acre at Country Station.	Net Profit per Acre.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Super	16	2·934	0·853	4 5 4	0 14 6	3 10 10
Control	16	2·081	..	..	..	..
Basic super	16	2·816	0·735	3 13 6	0 13 6	3 0 0
Basic super and blood ..	16	2·660	0·571	2 17 1	1 0 0	1 17 1
Control	16	2·089	..	..	..	..
Super and blood ..	16	2·869	0·780	3 18 0	1 1 0	2 17 0
Super	16	2·934	*	*	*	..
Basic super	16	2·816				
Basic super	16	2·816	0·156	0 15 7†	..	..
Basic super and blood ..	16	2·660	..	..	..	..
Super and blood ..	16	2·869	0·209	1 0 11	..	..
Basic super and blood ..	16	2·660	..	..	..	..
Super	12	2·863	*	*	*	..
Super and blood ..	12	2·933				

* Difference not significant. † The comparison of basic super and basic super and blood shows a difference in favour of the basic super, which cost 13s. 6d., as against £1 for basic super and blood.

From this table it will be seen that the application of manure was a paying one in every case. The differences between super and basic super and between super and super and blood are not significant, but both basic super and super and blood when compared directly with basic super and blood show a slight increase, indicating that blood in combination with basic super had a depressing effect on growth.

Table 5.—Effect of Application of Manures in 1924 on those of 1923, compared with 1923 Application (1924 Controls) and with one another.

(All plots falling on the controls of the 1923 experiment are eliminated, and in the case of super and control, Plots 2, 3, 4, and 5 are compared with Plots 7, 8, 9, and 10 respectively, &c.)

Treatment.	Number of Plots compared.	Yield of Hay per Acre.	Difference in Hay per Acre.	Value of Difference at £5 per Ton.	Cost of Manure per Acre at Country Station.	Net Profit per Acre.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Super	64	2·890	0·404	2 0 5	0 14 6	1 5 11
Control	64	2·486	..	..	..	..
Basic super	64	2·866	0·380	1 18 0	0 13 6	1 4 6
Basic super and blood..	64	2·788	0·185	0 18 6	1 0 0	Loss of 1s. 6d.
Control	64	2·603	..	..	..	..
Super and blood ..	64	2·950	0·347	1 14 8	1 1 0	0 13 8
Basic super	64	2·866	0·078	0 7 10*	..	..
Basic super and blood..	64	2·788	..	..	..	..
Super and blood ..	48	2·997	0·148	0 14 10	..	..
Super	48	2·849	..	..	..	..

* Here, as in Table 3, the addition of blood to basic super has had the effect of reducing the yield of the plots with that mixture to below that of basic super alone.

These results show that the second dressing of 1924 was paid for in the single hay crop, except in the case of basic super and blood. Here again the effect of the blood in combination with basic super seems to be a depressing one. Blood in combination with super gave a slight increase over super alone.

SUMMARY.

W. G. Macartney's Experiment.

(1.) In 1923—a season of extremely light rainfall—manurial dressings of 2 cwt. per acre did not pay in the hay crop taken three months after the application of the manures.

(2.) Eleven months after application a line of demarcation between the treated and untreated areas could be distinctly seen, but this difference was not apparent when the second hay crop was taken.

(3.) Weighings taken fifteen months after treatment showed a significant increase in the case of every manure.

General Conclusions applying to 1924 Experiments.

(1.) In every case, with one exception (basic super and blood, Table 5), the actual cost of manures at country stations had been more than paid for by the increase in one crop of hay.

(2.) If the growth of grass represented by one crop of hay is regarded as half the total growth for the year the net profit resulting from the application of the fertilizers is greatly increased above that shown in the tables.

(3.) The net profit resulting from the application of manures was always slightly in favour of super or basic super.

(4.) In one case only has the addition of blood to phosphate (super) caused an increase in yield—and that a very slight one. In the main its inclusion has not been profitable, and from the experimental data available the use of blood for top-dressing of pastures cannot be recommended.

(5.) In two cases the addition of blood to basic super has resulted in a lower yield than with basic super alone.

(6.) Excepting in the case of basic super and blood, the application of manures in 1924 on the manured plots of 1923 has left a good margin of profit in the single crop of hay. The increases due to the second application, however, have not been so great as those due to the first dressing. With the aid of a damp growing season in 1924 the residual effect of the 1923 manures was very evident.

(7.) As instanced by the grazing during the winter and early spring of 1924, the manures have had a decided effect on the palatability of the pastures.

(8.) The enhanced fertility due to the more vigorous development of clovers which generally accompanies phosphate manuring must be considerable, although its actual value cannot be measured.

(9.) The belated effect of the 1923 dressings indicates that, owing to the possibility of dry-weather conditions, top-dressing should be done in the winter (say, June) rather than in the early spring.

(10.) The amount of £5 per ton, on which the values of increases in hay are estimated, is purely a nominal figure, and should it be considered too great for this season's crop the substitution of a reasonably lower figure will in almost all cases still show a handsome margin of profit.

The writers' thanks are due to Messrs. W. G. Macartney and T. Bloor for facilities afforded in carrying out the experiments, also to Mr. W. Carter, who rendered valuable assistance. Mr. E. J. Fawcett, B.A., Assistant Instructor in Agriculture, Hastings, was very closely associated with the work in 1923. He compiled the results of the first season's work, and his valued assistance is duly acknowledged.

Seed-testing Practice.—At the New Zealand Official Seed-testing Station, in order to conform with American and European practice, the germination percentages of mangolds, beets, &c., will in future be expressed as percentages of the number of balls which show sprouts, irrespective of the number of sprouts per ball. The discarded method gave the total number of sprouts per 100 balls.

Noxious Weeds Act Orders.—The Southland County Council has declared Californian thistle and ragwort *not* to be noxious weeds within that county; the Portobello Road Board has similarly declared Californian thistle within its district. The following are recent declarations of plants as noxious weeds: Kiwitea County, hemlock; Carterton Borough, broom, elderberry, ox-eye daisy, pennyroyal, St. John's wort; Masterton Borough, hemlock and fennel.

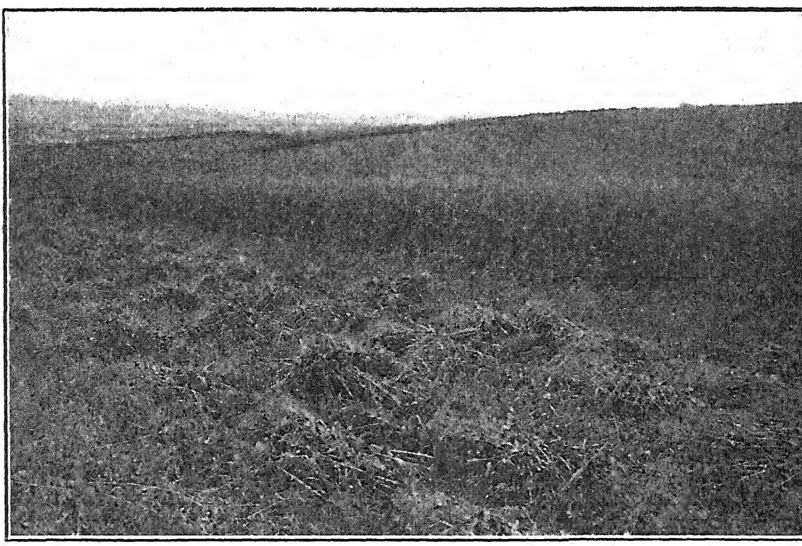
GORE EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1924-25.

R. McGILLIVRAY, F.L.S., Fields Division, Invercargill.

FORAGE CROPS. (SECTIONS 5A AND 5B.)

THE crops grown in these sections during the season consisted of Thousand-headed kale, chou moellier, cabbage, oats and peas, and rape. Germination in all cases was good. Cabbage and rape suffered badly from club-root, while Thousand-headed kale and chou moellier, although attacked, withstood the disease in quite a remarkable manner. Thousand-headed kale was not affected to any extent by the long spell of dry weather experienced during the summer.



CROP OF OATS AND PEAS AT GORE EXPERIMENTAL AREA.

OATS AND PEAS FOR HAY. (SECTION 6.)

The sowing consisted of Garton oats, 2 bushels, and partridge peas, 1 bushel, per acre. This resulted in a splendid crop, which was saved in a very bright condition. A considerable number of weighings were taken while the oats were in the ripening stage, in order to ascertain the difference between weights at that time and later when in the dry state. The samples taken were weighed again three weeks later, when it was found that the average dry weights were exactly one-third of the earlier weights.

SCOTCH TARES FOR SEED. (SECTION 7.)

This section was sown in February, 1924, at the rate of 1½ bushels of oats and the same quantity of tares per acre, together with superphosphate at 2 cwt. per acre. This was primarily a seed crop, the oats being combined for the purpose of keeping the tares up off the ground. Oats and tares, autumn sown, is a crop that has much to recommend it as a smotherer where Californian thistle is troublesome. The spring growth in this case was heavy and so dense that no weeds had any chance of showing up. The yield of tares was 658 lb. per acre.

OAT VARIETY TRIAL. (SECTION 8.)

The varieties in this trial were Crown, Golden Rain, Victory, and Great Mogul. They were sown in September, with basic superphosphate at 2 cwt. per acre. All varieties made very satisfactory growth. Golden Rain and Victory matured earlier than other varieties. Small birds did a great deal of damage to all varieties. The yields were as follows: Crown, 34 bushels; Golden Rain, 26 bushels; Victory, 31½ bushels; and Great Mogul, 42½ bushels per acre.

WHEAT VARIETY TRIAL. (SECTION 2.)

The varieties tested were Marquis, Major, and Solid-straw Tuscan. All were sown in August at the rate of 3 bushels per acre, and were manured with basic super. Marquis was the first to show above ground, and made rapid growth thereafter, being cut a fortnight before the other varieties. The yields per acre were as follows: Marquis, 16·25 bushels; Major, 21 bushels; and Solid-straw Tuscan, 33·33 bushels. In the case of Marquis the depredations of small birds were very severe, amounting to about half the crop.

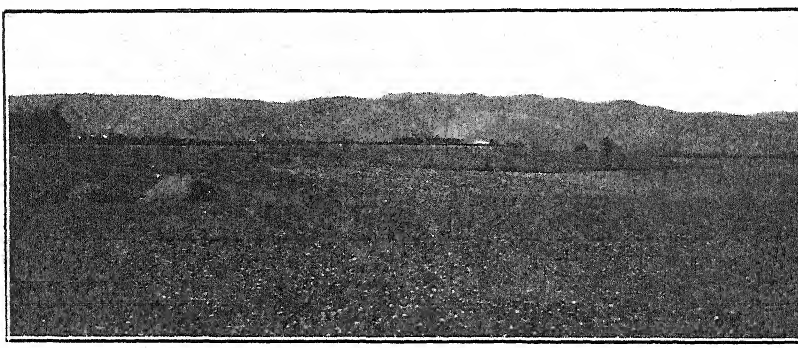
WHITE CLOVERS. (SECTION 9A.)

This experiment was laid down in December, 1923, and consists of equal-sized areas of Dutch white, English wild white, and New Zealand white. The trial is a most interesting one, and the section has had many visitors. The object is to ascertain the difference in habit of growth of the several types. Germination was very good in the case of the New Zealand clover, but rather unsatisfactory in the case of the other two. The Dutch white proved a larger plant than either of the others. The New Zealand white and English wild white were very similar in habit of growth, but the English was on the whole a smaller plant and later in flowering by about three weeks, and never at any time flowered to the same extent as the New Zealand strain. The whole area was limed with 10 cwt. per acre of burnt lime in August last, and top-dressed with basic super in September. Since being laid down the area has been hayed once and grazed when necessary.

MANURIAL TREATMENT FOR POTATOES. (SECTION 3.)

This test was undertaken for the purpose of obtaining data on manurial treatment for potatoes in the eastern districts of Southland. The scheme was as follows, all weights stated being per acre: Plot A,

super, 2 cwt. per acre. Plot B, super, 2 cwt.; kainit, ½ cwt. Plot C, kainit, ½ cwt.; sulphate of ammonia, ½ cwt. Plot D, super, 2 cwt.; kainit, ½ cwt.; sulphate of ammonia, ½ cwt. Plot E, super, 2 cwt.; sulphur, ½ cwt. These groups were repeated twenty times, and Plot A in each case was considered the control. The variety chosen for the experiment was Arran Chief. It was observed at time of planting that the tubers were encrusted with the sclerotia of corticium disease. This disease is quite common in potato crops, and in some quarters not considered of any consequence. Of recent years, however, the disease appears to have become more virulent, and in the case of this experiment it completely nullified the whole undertaking. In the yield from the area of 1½ acres there were not more than about six sacks of table potatoes. It was noticed that about 20 per cent. of the plants came through the ground having a very sickly appearance, and made little growth. The early shoots in many cases were injured, with the result that the plants put forth a second growth. This



EASTERN PART OF GORE EXPERIMENTAL AREA.

growth was lacking in vigour, and made but a feeble stand against the progress of the disease, and by the end of January 85 per cent. of the plants had succumbed. Where the complete fertilizer was used (Plot D) better growth was made for a time, but finally all plots appeared to suffer equally. Special measures will be taken next season to control this disease.

CARROT VARIETY TRIAL. (SECTION 9C.)

The varieties were Sinclair's Champion, Matchless White, and Altringham. The seed was sown on 22nd October at 1½ lb. per acre. Weights were taken in May with the following results: Sinclair's Champion, 14·65 tons; Matchless White, 19·45 tons; and Altringham, 9·50 tons per acre.

TICK BEANS AND WHEAT FOR CHAFF. (SECTION 2B.)

The growth of the beans in this crop was not up to expectations, but the low rainfall during the growing season was to some extent responsible for this. The yield was 2 tons per acre (dry weight). The

chaff was well up to expectations, and proved a most palatable ration for horses.

LUCERNE. (SECTION 1A.)

The lucerne stand was top-dressed with burnt lime in August, and the growth during the season was good. The weight of hay produced was approximately 2½ tons per acre.

TRIAL WITH SWEDES FOR CLUB-ROOT RESISTANCE. (SECTION 9B.)

In this trial several varieties of swedes, claimed to be immune or highly resistant to club-root, were each tested against ordinary commercial swedes of similar type, the commercial lots serving as a control. The so-called immune varieties were as follows: Invine's Purple-top, Danish Family 4, Sutton's Hardy White, Bangholm, and a selected lot the seed of which had been saved on the Gore Area from Bangholm roots that were free from club-root. All plots were sown on 13th November, and germination was good. At thinning-time club-root was prevalent in the case of the commercial swedes. Throughout the whole period of growth the Gore special selection was very healthy, and at time of examination there were less blanks in this variety than in any of the others. The results were as follows:—

Variety.	Number of Roots examined.	Number free from Club-root.	Number diseased.	Percentage of Infection.	Yield per Acre.
					Tons.
(1) Irvine's Purple-top ..	376	181	195	51·86	12·37
Commercial ..	364	116	248	63·13	12·36
(2) Danish Family 4 ..	462	253	209	45·23	9·52
Commercial ..	385	117	268	69·61	8·16
(3) Sutton's Hardy White	404	129	275	68·06	6·12
Commercial ..	375	88	287	76·53	4·89
(4) Bangholm ..	417	66	351	86·57	8·84
Commercial ..	344	38	306	88·95	5·44
(5) Gore Selection of Bangholm	467	256	211	45·18	9·79
Commercial ..	385	22	363	94·28	5·44

"DISEASE-RESISTANT" TURNIP TRIAL. (SECTION I.)

This test was undertaken for the purpose of ascertaining the degree of resistance of Irvine's Green-top Yellow turnip to club-root. As with the swedes experiment, this turnip was grown in conjunction with a control commercial turnip of similar type, two drills of each variety, the plots being repeated sixteen times. The seed was sown on 13th November, with basic super at 2 cwt. per acre. Germination was only fair in all plots. The plants throughout of Irvine's turnip were much more robust than those of the other. Club-root was very noticeable in the controls at the time of thinning, but was not observed to any extent in Irvine's. In May the bulbs were examined and weighed, with the following result:—

Variety.	Number of Roots examined.	Number free from Club-root.	Number diseased.	Percentage of Infection.	Yield per Acre.
					Tons.
Irvine's Green-top Yellow	610	323	287	47·0	12·8
Commercial	539	196	343	63·6	7·5

Mr. T. Pattinson, now of the Winton Area, was Overseer at the Gore Area while the various operations here recorded were under way, and carried out the work in his usual capable manner.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING FACTORY AVERAGES FOR 1924–25.

FOLLOWING the practice of the two preceding years, the Dairy Division has compiled for the *Journal* a list of butter and cheese factories throughout the Dominion which have obtained for their export produce average grades respectively of 92 and 91 points or over, covering the official year ended 31st March, 1925. It may be mentioned that as from 1st January last the minimum points for first-grade creamery butter and factory cheese were raised from 88 to 90. First grade therefore now runs from 90 points to 100 points. The list is as follows:—

BUTTER-FACTORIES WITH AN AVERAGE GRADE OF 92 POINTS AND OVER FOR YEAR ENDED 31ST MARCH, 1925.

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Rangitikei	1360	Rangitikei	94·17
Wairoa	1345	Wairoa	94·11
Waitaki	812	Waitaki	93·94
Wangaehu	1326	Wangaehu	93·93
Raetihi	717	Raetihi	93·69
Maketawa	342	M.D.C.	93·56
Taieri and Peninsula (Dunedin)..	54	Peninsula	93·54
Kaitaia	1298	Kaitaia	93·49
Manutahi	495	Manutahi	93·48
Rata	93	Rata	93·42
Cheltenham	3	Pakeha	93·40
Rangiwahia	750	Quail	93·35
Mangorei	345	Mangorei	93·33
Levin	910	Lake	93·32
Mells	764	Mells	93·32
Pio Pio	603	Pio Pio	93·27
Tariki	1818	Tariki	93·27
New Zealand (Ngatea) ..	291	Anchor, &c.	93·16
Shannon	1489	Shannon	93·15
Awahuri	664	Red Rose	93·14

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Tikorangi	102	Shield	93·13
Taihape	1188	Tikapu	93·13
Kaitieke	1119	Kaitieke	93·05
Kairanga	1768	Longburn	93·02
Waitanguru	1154	Golden Jem	93·00
Maungatapere	1710	Moana	92·93
Tarurutangi	728	Champion	92·92
West Coast Farmers'	675	Silverpine	92·92
Opotiki	337	Opotiki	92·91
Aria	1734	A.D.C.	92·91
Moa Farmers'	341	Inglewood	92·84
Akaroa	1579	Akaroa	92·83
Heretaunga	1230	Heretaunga	92·82
Featherston	360	Featherston	92·82
Kiwi	299	K.D.C.	92·80
Oruru-Fairburn	1337	Fairy	92·78
Mangatoki	136	Mangatoki	92·77
Murchison	1888	Airship	92·75
Tolaga Bay	1007	Tolaga Bay	92·75
Pihama	627	Pihama	92·69
Ruawai	66	Ruawai	92·69
Midhirst	110	Rugby	92·68
Mauriceville	14	Mauriceville	92·66
Kia Ora	926	Kia Ora	92·66
North Taranaki	723	Flax	92·65
Hauraki Plains	1900	Hauraki Plains	92·64
Manakau	815	Manakau	92·64
Kuku	905	Ohau	92·63
Maungaturoto	1407	Maungaturoto	92·61
Tai Tapu	175	Tai Tapu	92·60
Farmers' Dairy Federation	336	Murihiku	92·55
Whangarei	1720	Kauri	92·52
Bay of Plenty	1399	Bay of Plenty	92·51
Municipal Milk	202	Rahui	92·48
Hawera	346	Federation	92·47
Avon	963	Avon	92·43
East Tamaki	301	East Tamaki	92·42
Tarata	631	Tarata	92·40
Waitaki (Invercargill)	160	Waitaki	92·38
Eltham	31	Eltham	92·37
Te Aroha	344	Overseas, &c.	92·31
Northern Wairoa	1358	Northern Wairoa	92·29
Konini	1203	Konini	92·26
Waitara	726	Waitara	92·24
Canterbury Central	55	Fern Leaf	92·24
Taieri and Peninsula (Oamaru)	1234	Peninsula	92·23
Arahura	1516	Arahura	92·20
New Zealand (Otorohanga)	185	Anchor, &c.	92·19
Bell Block	488	Bell Block	92·16
Sefton	28	Star	92·16
Rongotea	8	Rongotea	92·14
Co-operative of Otago	266	Huia	92·12
Golden Bay	146	Sovereign	92·12
Riverdale	106	Trident	92·10
Lepperton	49	Lepperton	92·08
Normanby	24	Steering Wheel	92·05
Karamea	1570	Karamea	92·04
Kaipara	794	Poplar, &c.	92·03
Golden Coast	991	Golden Coast	92·03
Cheddar Valley	611	Cheddar Valley	92·00
Whangaroa	658	Whangaroa	92·00

CHEESE-FACTORIES WITH AN AVERAGE GRADE OF 91 POINTS AND OVER FOR YEAR ENDED 31ST MARCH, 1925.

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Te Horo	134	Allies	93·30
Maungataua	1708	Maungataua	93·15
Omimi	74	Omimi	93·09
Ballance	1	Ballance	93·00
Opouriao	1169	Opouriao	92·94
Nireaha	335	Nireaha	92·92
Kuku	905	Ohau	92·91
Temuka	207	Ohape	92·91
Ryal Bush	477	Ryal Bush	92·75
Mosgiel	161	Mosgiel	92·70
Kairanga	182	Kairanga	92·69
Waianiwa	1171	Waianiwa	92·67
Stirling	292	Stirling	92·63
Tisbury	701	Tisbury	92·60
Little Akaloa	32	Little Akaloa	92·56
New Zealand (Aka Aka)	121	Anchor, &c.	92·52
Rimu	1155	Rimu	92·49
Paretai	271	Paretai	92·47
Cambridge	128	Cambridge	92·46
Awatuna	60	Awatuna	92·43
Oroua Downs	94	Oroua Downs	92·43
Toa Toa	817	Toa Toa	92·36
Milford	267	Milford	92·36
Waikouaiti	18	Waikouaiti	92·35
Norfolk	1093	Norfolk	92·32
Mangatoki	1086	Mangatoki	92·32
Okato	85	Okato	92·28
Edendale	36	Edendale	92·28
Maharahara	984	Maharahara	92·28
Alton	1890	Alton	92·27
Opouriao	1813	Ruatoki	92·26
Waimana	1817	Waimana	92·25
Pihama	627	Pihama	92·24
Kai Iwi	1565	Kai Iwi	92·23
Barry's Bay	401	Barry's Bay	92·21
Takamatua	33	Takamatua	92·21
Drummond	1823	Drummond	92·20
Pihama	1111	Pihama	92·19
United	1220	Whariti	92·19
Riverbank	985	Riverbank	92·18
Taratahi	101	Taratahi	92·18
Tokoroa	255	Tokoroa	92·18
Whiterig	798	Whiterig	92·16
Tuturau	132	Tuturau	92·13
Horsham Downs	1089	Horsham Downs	92·13
Milton	1030	Milton	92·12
Woodville	1892	Woodville	92·12
Brydone	1821	Brydone	92·10
Orari	254	Orari	92·10
New Zealand (East Tamaki)	149	Anchor	92·08
Pembroke	234	Pembroke	92·05
Wairewa	471	Wairewa	92·05
Patua	73	Patua	92·02
Pine Bush	543	Pine Bush	92·01
Kaitangata	1648	Kaitangata	92·01
Dannevirke	391	Dannevirke	92·01
Glen Oroua	906	Glen Oroua	91·99
Mata	258	Vale	91·99

CHEESE - FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Kakaramea	630	Penguin	91·98
Gorge Road	567	Gorge Road	91·97
Seaward Downs	702	Seaward Downs ..	91·96
Clandeboye	1517	Clandeboye	91·96
Mells	1148	Mells	91·96
New Zealand (Hairini) ..	120	Anchor, &c.	91 95
Ashburton	81	Ashburton	91·95
Kaimata	992	The Oaks, &c. ..	91·94
North Taranaki	212	Waipapa	91·93
Marima	195	Marima	91·93
Manakau	815	Black Swan	91·91
Staveley	1719	Staveley	91·91
Brunswick	1290	Brunswick	91·89
Otamita	17	Otamita	91·88
Makowhai	213	Makowhai	91·85
Kaponga	1696	Rowan	91·84
Momona	1010	Allantown	91·84
Bainesse	808	Bainesse	91·84
Kokotau	809	Kokotau	91·84
Hamua	164	Hamua	91·84
Tokomaru	972	Tokomaru	91·84
New Zealand (Rukuhia) ..	114	Anchor, &c.	91·82
Mataura	38	Mataura	91·80
Mangatoki	136	Mangatoki	91·75
Tariki	216	Miro	91·74
Mells	764	Mells	91·73
Kiritaki	1521	Premier	91·73
New Zealand (Eureka) ..	353	Anchor, &c.	91·72
New Zealand (Matatoki) ..	177	Anchor, &c.	91·72
Tuna	209	Tuna	91·71
Otautau	1610	Otautau	91·71
Freshford	1224	Freshford	91·71
Bell Block	71·	Dove	91·70
Cam	168	Cam	91·69
Boggy Burn	703	Boggy Burn	91·69
Takapau	75	Takapau	91·68
Northope	383	Northope	91·67
Kohi	923	Kohi	91·67
Mangatoki	1087	Mangatoki	91·67
Awarua	545	Awarua	91·67
Okato	48	Puniho	91·66
Henley	1627	Henley	91·64
Tamaki	1463	Bell	91·63
New Zealand (Okoroire) ..	189	Anchor, &c.	91·61
Eltham	1039	Rotokare	91·60
Silverstream	264	Silverstream	91·60
Thornbury	1581	Thornbury	91·60
Kennington	205	Kennington	91·60
Woodlands	1485	Woodlands	91·60
Mokotua	67	Mokotua	91·59
Aparima	188	Aparima	91·59
Awatuna	1622	Taungatara	91·58
Wairuna	712	Wairuna	91·57
Kaponga	1694	Kaponga	91·57
Wyndham	59	Wyndham	91·54
Pukerau	480	Pukerau	91·53
Tamaki	58	Big Ben	91·53
Ngaire	25	Triumph	91·53
Rahotu	1800	Rahotu, &c.	91·47

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Morton Mains	1604	Morton Mains	91·47
Waitoitoi	20	Waitoitoi	91·45
Tariki	1700	Tariki	91·44
New Zealand (Wharepoa)	173	Anchor, &c.	91·44
Kakepuku	83	Kakepuku	91·44
T. L. Joll	1723	Maori Chief	91·43
Lower Valley	322	Lower Valley	91·42
Mangawhata	1343	Mangawhata	91·42
Kaponga	1695	Riverlea	91·41
Tikorea	833	Tikorea	91·40
Wright's Bush	206	Wright's Bush	91·39
T. L. Joll	1727	Maori Chief	91·38
Hauraki Plains	1900	Hauraki Plains	91·38
Tawaha	1722	Tawaha	91·36
Warea	87	Warea	91·36
Kaupokonui	633	Kaupokonui	91·35
Island	72	Island	91·34
Rongokokako	280	Rongo	91·34
North Tiraumea	1599	Kohinui	91·31
Tiakitahuna	1889	Tahuna	91·30
Okato	57	Leith	91·29
Menzies Ferry	623	Menzies Ferry	91·29
Pihama	1112	Pihama	91·27
New Zealand (Huirau Road)	172	Anchor, &c.	91·27
Manawatu	1189	Reliance	91·27
Fairfax	1004	Fairfax	91·25
Lochiel	659	Lochiel	91·24
Royal Oak	693	Royal Oak	91·23
Mangatoki	256	Mangatoki	91·23
Kaupokonui	1100	Kaupokonui	91·23
Manutahi	495	Manutahi	91·22
Whiteman's Valley	215	Daybreak	91·22
Kaupokonui	1099	Auroa	91·21
Pahiatua	140	Rival	91·18
Collingwood	1742	Collingwood	91·18
Bell Block	488	Bell Block	91·18
Eltham	1047	Cheal	91·16
Bruntwood	1534	Bruntwood	91·16
Goodwood	1559	Goodwood	91·16
Riverdale	106	Trident	91·15
Switzers	802	Switzers	91·14
Mangaroa	252	Onward	91·14
Ashhurst	1886	Hinemoa	91·14
Bidwill	270	Bidwill	91·14
Eltham	1043	Mata	91·12
Pigeon Bay	805	Pigeon Bay	91·11
Eltham	31	Eltham	91·08
Tararua	444	Tararua	91·08
Rongomai	1001	Rongomai	91·06
Otaraia	1721	Otaraia	91·05
Lepperton	49	Lepperton	91·04
Eltham	1036	Rawhiti	91·03
Kaupokonui	1733	Katua	91·03
Kaupokonui	174	Skeet	91·02
New Zealand (Manawaru)	77	Anchor, &c.	91·02

SEASONAL NOTES.

THE FARM.

LOW-LYING PADDOCKS.

THE practice of stocking low-lying paddocks when waterlogged is to be strongly condemned. It must be admitted that many farms have no high land on which to feed stock during the winter, but the area used should be reduced as much as possible, and every available paddock left unstocked while wet and reserved for spring and summer feed. This can only be done by growing sufficient hay, silage, and roots to make the stock more or less independent of what little grass there may be. Wherever possible hay and roots should be carted from the flats to the poorer hills, and the stock maintained there during the winter. The dairy cows as they calve should not be expected to wander round water-logged paddocks looking for a bite of grass. They would be better confined to a small, dry area and more or less stall-fed, and it would certainly be much better for the pasture. The great growth of buttercup, pennyroyal, and docks seen on low-lying pastures after a wet winter is a direct indication of the damage done by winter stocking.

DRAINAGE.

Open ditches should be inspected after flooding, and any obstructions removed from time to time. The mouths of mole or tile drains should also be watched after heavy rains and any blockage investigated. In such cases wet patches above ground in the known course of the drain will be observed, and by digging down the cause will usually be located. Indications of want of drainage in many fields will now be apparent, and plans for future work should be thought out to be materialized later. Surface water should be let off areas under crop after heavy rain, but surface draining is more or less of a makeshift, and every endeavour should be made to under-drain as soon as possible. Money spent on cultivation, lime, or manures is largely wasted where insufficient drainage is the controlling factor.

LIMING.

The coming month is a suitable period for carrying out liming operations. For the heavier types of clay land, drained swamp, &c., the use is advised of from 10 cwt. to 1 ton of ground burnt lime, or on lighter soils crushed limestone (carbonate of lime) from 1 ton upwards per acre. Even if no marked result is observed in plant-growth from the use of lime, there can be no doubt that the resultant feed contains quality which will be reflected in the appearance of the stock. Farmers must be warned, however, against thinking that lime is a cheap substitute for manure. The practice of mixing lime and manure is one which often results in the crop receiving about half the phosphate which it requires. Where heavy liming is practised provision should also be made for keeping the soil provided with organic matter. Liming increases the activity of the bacterial life in the soil,

but unless the organic content is kept up the general fertility tends to suffer.

TILLAGE.

Generally speaking, the average land is more or less saturated at this period, which means that cultivation work should be held in abeyance. Ploughing should always be postponed if the furrow shows a glaze caused by the pressure of the mouldboard. A certain amount of risk may be taken in turning over old lea when somewhat wet, but never in the case of land recently under cultivation. Provided soil conditions are suitable, however, no reasonable opportunity should be lost in turning areas intended for spring crops. Far too many crop failures are due to late preparation and sowing on raw soil not sufficiently weathered.

LUCERNE AND RED-CLOVER STANDS.

Under Canterbury conditions lucerne-fields which have not already been cultivated should be deep-grubbed at once in order to allow winter conditions to improve the soil for next season's growth. The top-dressing of lucerne stands with 2 cwt. super per acre may now also be done.

In Marlborough, when conditions are dry enough, July is the best month for the cultivation of clover and lucerne stands. Land being prepared for lucerne should be well limed at the rate of 1 ton of crushed carbonate of lime, at the latest by the end of July. On the earlier country it should be the aim either to sow the lucerne in August or else to postpone the sowing till October. Lucerne should be given a chance to germinate before the weeds get well away, or failing this the sowing should be delayed so that the land may first be well cultivated and freed from all weeds. Red-clover stands which show signs of running out should be cultivated with the lucerne cultivators, surface-sown in weak places, and brush-harrowed. The whole stand should then be top-dressed with super at the rate of about 2 cwt. per acre.

MISCELLANEOUS.

Potato-pits should be inspected occasionally to see that they are frost-proof and dry. In most cases picking over will commence now, and this should be proceeded with if many rotted potatoes are noticed, otherwise the remainder of the potatoes in the pit may be contaminated.

July is a good month for cleaning yarrow-infested fields. Ploughed and grubbed occasionally, yarrow-roots will carry sheep very effectively in midwinter, and, providing the ground is dry, the winter fallow puts the land in good heart for the following spring-sown crop.

Land in which it is intended to grow commercial crops of garden-peas for seed should now be well cultivated and top-dressed at suitable opportunities. Better results are usually secured in this way than by sowing the manure with the pea-seed.

Club-root in turnips and swedes has taken a heavy toll in many districts this season. There is considerable carelessness in the use of diseased roots, and they are frequently thrown out on the manure heap, to be later carted out on the land, thus spreading the disease.

—*Fields Division.*

THE ORCHARD.

PRUNING.

PRUNING, which was dealt with at some length in last month's notes, should be pushed ahead with all possible speed. This work takes precedence over almost all other operations during the dormant period. Some varieties, such as Rome Beauty, are often left until the trees show signs of coming into flower. This practice is quite a good one if the pruner is unable to determine which are fruit-buds. Rome Beauty invariably bears its fruit on the ends of young laterals, and it is difficult at times to determine whether the terminal buds are flower or leaf buds. Where such is the case no harm will result if pruning is deferred until one can be certain.

Gathering up the prunings is often looked upon as being very tedious and is at times neglected. No progressive grower, however, would leave this work undone, and it should be regarded as important. Moreover, all the prunings should be burnt, otherwise they are only a source of disease infection to the orchard.

SPRAYING.

It will not be necessary to do much spraying at this period of the year. However, where San Jose scale has been in evidence on stone-fruit trees they should receive a dressing of lime-sulphur, 1–12 to 1–15. Care should be always taken to cover every portion of the tree with the spray, otherwise any portion missed may easily become a source of reinfection. Varieties of stone-fruit very susceptible to leaf-curl should be sprayed in July either with bordeaux, 8–6–40, or pure bluestone, 1–12 to 1–15, followed in August with a further application, details of which will appear in next month's notes.

All spraying-material should now be procured in readiness for the spraying season, which commences in real earnest during August.

PLANTING.

Where extension of orchard areas is contemplated, and the land has been ploughed as previously advised, it should now receive several diskings, &c., when the weather is favourable. Thorough preparation of the soil before planting is a very important factor, and one upon which future success largely depends. If the weather is favourable and the soil in good order, planting may be done, but unless the best possible conditions prevail the work is better deferred. Planting operations carried out when the soil is wet can only have a bad effect upon the trees; moreover, the land is left in a very unsatisfactory state for future working.

If the trees intended for planting have come to hand. a trench should be dug in a nice dry location and the trees heeled in it, covering the roots with earth and tramping firmly. The trees will keep in this position until required. Before planting in permanent position cut off all broken and bruised roots. When digging the hole see that the centre is slightly higher than the sides, in order that when spread out the roots will have a downward tendency. Take care to plant the trees about the same depth as they were in the nursery. When the trees have been placed in position in the holes,

spread the roots out evenly, cover with fine soil, and tread firmly. This is necessary in order that the young rootlets may get a hold of the soil. After the first filling of earth place a handful of superphosphate around the outer edge of the hole, then fill in with soil. Always leave a few inches on the surface untrodden. Trees may be pruned back either before or after planting.

—*L. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

Where new plantations are contemplated the work should now be put under way. The first essential is that the soil be in a fit condition for planting. Citrus, as compared with many other fruit-trees, are shallow-rooting, but this does not mean that soil-cultivation to a shallow depth only is required. On the contrary, deep preparatory cultivation is, on the majority of soils, very necessary to ensure good drainage and sweetness. Once the trees are planted it is impossible to undertake uniform subsoil disturbance; such work is therefore better done prior to planting. The aim should be to obtain a well-drained area, subsoiled, and with the surface soil well broken up but retained above the subsoil. Provision should be made for permanent shelter plantations, adequate protection from cold winds and frosty air-currents being necessary. Planting may be done at any time up to late spring, but the sooner the better, as the trees become better established if put in early.

Seasonal work in existing plantations will comprise the following: Harvesting of fruits ready; trimming of shelter-belts; cleaning out of drains and, where required, the making of furrows to take away surplus rain-water; and, above all, the removal of all twigs and branches which sweep or drag on the soil, as a precaution against the spread of citrus brown-rot.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

BREEDING FROM PULLETS.

It may be as well to reiterate that if pullets are desired for laying early next autumn (when eggs may be expected to command good prices) the chickens should be hatched out during July. It may be said, and rightly so, that on the majority of poultry-farms eggs from the adult stock are not available for hatching purposes at this period, owing to the birds not having resumed laying after the moulting process. The subject is certainly a difficult one, especially in the South Island, where few second-year birds will lay sufficiently early for incubation work to commence in July. In such cases the only safe course is to use pullet-eggs for incubation rather than to delay hatching operations.

In a general way it is not advisable to breed from pullets if hens can be obtained, but, as with all other things pertaining to poultry-keeping, local conditions must always be taken into account. The use of pullets is not so much objected to when they have commenced to lay without being forced early in the year, and have moulted at the usual time

—that is, with the adult birds, about April or May. Further, the birds should be well grown, and at the time of mating should produce a standard-weight egg—2 oz. or over. Moreover, the pullets used for breeding should be only those bred from hens in the preceding year. Breeding from pullets generation after generation is not recommended.

Wherever possible the pullets should be mated with a specially vigorous second-season male. Cockerels and pullets should never be mated together where possible to avoid it. Of course, reference is now made only to early hatching for the production of pullets for autumn and early winter laying, as August and September share favour as being the best months for hatching out the main flock of layers.

BROODING-PROBLEMS.

While the quality and constitution of the breeding-stock determine to a large extent the quality of chicks produced, satisfactory progeny depends on something more than parentage. A high-type layer cannot be bred from inferior stock, but progeny from the best foundation blood ever known will prove disappointing if the chicks are not fed well and carefully handled from the day they leave the shell and right through all stages of their development.

Notwithstanding the great improvement that has taken place in brooder appliances during recent years, and the manner in which the work of rearing incubator chicks has been simplified, so far nothing has been designed to perfectly take the place of the natural mother. This is chiefly because, whatever the weather conditions, the chicks can always enjoy under the hen that absolute uniformity of warmth demanded by them, and at the same time breathe the fresh air so essential to their welfare. Thus in the artificial rearing of chickens the greatest success will never be achieved unless the attendant pays special attention to the control of temperatures and ventilation at all stages of the process. Even with the best makes of brooders there are no hard-and-fast methods that can be laid down to ensure success. Local conditions and extremes of weather—both cold and heat—are apt to upset the best set of instructions ever planned. The only safe course is to go back to the old hen and study her methods of rearing chickens. A fact not to be overlooked is that the hen, in nature's medium, can rear her young without any assistance from a human being. Thus if man is to be independent of nature he must by careful study and observation seek to provide conditions resembling the natural method as closely as possible.

There are probably more chickens that die owing to chills, or fail to reach a proper stage of development through their evil effect, than from all other causes put together. The common causes of chill are irregular temperatures in the brooder-box, overheating, and insufficient ventilation. Removing the chicks too soon from the incubator to the brooder before they are dry, and giving them too much freedom for the first few days, are also frequent causes of chill. The most manifest symptoms of chill are bowel troubles, excessive thirst, droopy wings, a distressed chirp, and no inclination to either leave the brooder or to eat. When these symptoms show themselves heavy mortality rapidly ensues. Indeed, in such cases it is useless trying to effect a cure, as usually the chicks will die in spite of anything that can be done for

them. Prevention is the only way of dealing with this trouble—viz., by having the brooder so constructed and attended to that extremes of heat and cold may be prevented, while at the same time never allowing stuffiness or draughts to exist.

Feeding, Exercise, and Cleanliness.

On no account should the chicks be overfed during the first few days; indeed, they require no food at all for at least twenty-four hours after being hatched. For the first week especially it is always a good plan to underfeed rather than overfeed. The chick is hatched with a good supply of egg-yolk food, which is drawn into its body about the time the egg commences to pip. Plenty of sleep and a comfortable degree of heat, with provision made for fresh air without draught, are the chief requirements of a newly hatched chick.

The hen should be studied in this respect. Where there is no machine to grind grains sufficiently small for young chicks it will usually pay to purchase a reliable brand of chick-raiser. In these there is usually a variety of grains, and rightly so, as no one grain contains all the elements necessary for healthy chick development. Here the mother hen with her brood when on a good range gives a striking lesson. If the crop of a chicken being reared under these conditions is opened up, a great variety of food such as soft seeds, tender sprouts of grass, insects, and worms will be found. This also provides the lesson that it is unnatural for a young chick to eat hard grain such as broken maize, wheat, &c. With such foods it is always a wise course to moisten the grains with hot water or milk, and allow them to swell before being fed to chicks during the early brooder stages. If there is any doubt on this question a hatch should be divided, giving one half the dry food and the other half food that has been moistened before feeding; then watch results.

Quite apart from any ration that may be fed, it is always a good plan to provide the chicks with a liberal supply of wheat-bran. This may be placed in a shallow receptacle and left for the birds to pick at. Charcoal and grit should also be provided in a similar manner, and be in reach of the chicks at all times. A good supply of finely cut green stuff should be fed daily.

For chicks to be healthy they must have ample exercise, such as may be obtained in a state of nature. There is no better way of inducing this than by scattering a little broken wheat or hulled oats in the litter, so that the birds will be induced to scratch and hunt for the grains. Another way of inducing exercise is to tie up some green material sufficiently high that the chickens will have to jump to secure it.

Strict attention to cleanliness is another important matter. Indeed, it is one of the secrets in successful chicken-rearing. Dirty quarters encourage vermin and disease.

FALSE ECONOMY IN THE FOOD BILL.

One of the worst forms of false economy is to save in the quality and quantity of food for a laying flock. Far better is it to feed half a flock thoroughly well than put a whole flock on an inferior diet or on half rations. Feed is certainly high in price, but nothing will be gained

and much will be lost by not giving the laying bird as much good food as it will eat without waste. Many complaints have reached me of pullets going into a moult just when expected to lay heavily. In most cases this has been traced to underfeeding or the supply of a food of inferior quality which the birds do not relish. It is poor economy, even when eggs are cheap, to keep fowls on a mere living diet, but with eggs selling in the region of 4d. each it is obviously a decidedly weak policy. It is only the well-fed pullet that will produce a maximum yield in the dear-egg season.

The only safe way of reducing the food bill is to provide an abundance of green food, which the majority of producers can grow themselves. In this connection the growing of a patch of lucerne (or even one or other of the clovers) is strongly recommended. These highly nitrogenous plants, finely chaffed and fed separately, will prove most effective for egg-production and be decidedly economical. Even during the winter months well-cured finely chaffed lucerne or clover hay, if boiled or steamed overnight, will make a valuable addition to the morning mash, it having the effect of making the mash appetizing and thereby increasing the egg-yield. The chaff may also be fed separately in a boiled form to birds of all ages. Even chickens a few weeks old will relish it. Unfortunately, in too many cases the lucerne chaff—and particularly the meal—sold for poultry-feeding consists largely of fibrous material, which would be dear at practically any price for promoting heavy egg-laying. Wherever possible the poultry-keeper should grow his own lucerne, as he then will not only be assured of spring and summer green food, but will also have confidence in the quality of the chaff for winter use.

Merely as a laxative, and for the maintenance of a healthy condition, probably there is nothing which will pay the poultry-keeper better to grow than a crop of silver-beet. This plant is not only a heavy cropper, but is also relished by birds of all ages.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

MOVING OF BEES.

If it is desired to move colonies to a new location the work should be carried out at the present season while the bees are dormant. Great losses are often caused by beekeepers postponing moving until the spring. It is well to remember that in our climate—from one end of the Dominion to the other—the dormant condition lasts but a very short time, and full advantage should be taken of it, more especially when the bees are transferred only a short distance. In the latter case there will be an inevitable loss of bees unless the weather conditions are absolutely wintry. The risk in moving bees longer distances is, of course, not as great, because when they are moved from their old landmarks they will not desert their hives until they have taken an inventory of their new surroundings. However, in long-distance removal there is another danger to be feared—namely, that by overheating the colonies a condition known as "scalded brood" may be produced, and result in the destruction of

thousands of embryo bees. The wise apiarist will therefore invariably choose the depth of winter for moving his bees either long or short distances.

PERMANENT SHELTER.

This is the season when it is most evident to the observant apiarist that bees require plenty of shelter from high winds. Where necessary, the planting of shelter-hedges to protect the apiary should now be taken in hand. Experience proves that bees in sheltered positions thrive far better than those in exposed situations. If the hives are protected, the bees can take exercise every sunny day during the winter months, and this exercise is essential to their well-being, as it is only in flight that bees can properly rid themselves of their excreta. Where sufficient shelter is not provided numbers of bees are lost through being beaten down by cold winds and rendered unable to return to their hives. Apart from the benefit to the bees, the apiarist will find his work much more congenial when he himself is protected by permanent shelter. Shelter-hedges should be grown to a height of about 8 ft. and no higher, and this will afford ample shelter for a large apiary. Of the many quick-growing hedges giant privet and tagasaste ("tree-lucerne") are perhaps the best. These plants have been tested throughout the Dominion with good results. In the South yellow-barberry holds pride of place as a hedge for apiaries, because, in addition to affording ample shelter, it yields an abundance of pollen and nectar in the early spring. Whatever species are used, planting should be done with the idea of forming a thick hedge, and not to form a plantation. If tagasaste or giant privet are planted they should be well protected from stock.

LIQUEFYING GRANULATED HONEY.

That honeys granulate and become solid in a certain time is well known to most beekeepers. This phenomenon has given rise to much speculation among consumers as to purity, and consequently producers of pat honey have had to educate the public, who formerly were suspicious that granulated honey was mixed with sugar. The crystallization of honey may be taken as a test for purity. Practically all the honey produced in New Zealand granulates, and the beekeeper may find it necessary to liquefy his honey when bottling. Many beekeepers are unable to procure small vessels in the extracting season, or their time is so much taken up attending to the bees that the honey is run off into larger vessels for the time being. Where the work of putting up the honey in retail packages has been postponed it may now be done.

Liquefying is an important part of the producer's work, and must be carried out with great care, as neglect in this direction will lead to a poor article being put on the market and an injury to his trade. It must be understood that honeys brought to high temperatures become darker in colour and lose their flavour; besides, the higher alcohols which give honey its aroma are driven off. When honey is heated to 170° or 180° F. and over, decomposition of certain sugars sets in, and as a result an inferior article results. Such honey is often seen for sale on the local markets, and tends to deter the average person from eating any honey whatever.

On no account should honey be liquefied by the direct application of heat, and it is extremely important that the temperature should not exceed 140° F. If it is necessary to liquefy bulk honey, this may be done by immersing the vessel in water which is brought gradually to 150°. At this temperature the honey will melt. Clover honey readily liquefies at about 140°. The process of liquefaction cannot be hurried, and if the mass of honey does not melt quickly, then it must be allowed to remain in the water from three to four hours. On no account should greater heat be applied. Too much stress cannot be placed on this point, as on it depends future sales and repeat orders. An ordinary washing-boiler is an excellent vessel to use where granulated honey is to be melted, but one must be sure that the tins are firmly soldered before immersing them. In order that the containers may not come in contact with the boiler it is advisable to place one or two small boards on the bottom of the copper. The tin to be heated is placed on the boards, and care must be exercised in filling the boiler with water. When this has been done, heat may be gently applied until the mass is dissolved. Liquefying honey is at the best a tedious process, but if good results are to be obtained the necessary amount of time must be spent on the operation.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

On the warmer lands growth will recommence towards the end of the coming month. The first opportunity should be taken to hoe the growing crops of early cabbage, cauliflower, broccoli, peas, and lettuce, helping them along where necessary with a little chemical fertilizer. On land well manured and prepared plant out main-crop cabbage, cauliflower, lettuce, and onion plants, these being from seed-beds laid down in late autumn. Plant also sets of shallots and garlic, artichokes, and early potatoes. From 3 cwt. to 4 cwt. of superphosphate and half that quantity of sulphate of potash per acre applied at this period will usually be found a good dressing. This work should be undertaken as soon as the land is sufficiently dry, friable, and warm, and growth commences in ordinary hardy vegetation. Sow early peas and lettuce, and, on firm, clean ground, the main crop of onions where the system of spring sowing is adopted. Rhubarb and asparagus beds will soon commence to make new growth for harvesting they should be assisted now by a liberal dressing of manures.

BUSH-FRUITS.

Many growers gather heavy crops of berries from currant, gooseberry, and raspberry gardens from year to year without manuring the plants, and wonder why they go back in condition. The remedy is generous manuring for heavy-cropping bushes, and this should be applied now. In the absence of well-prepared organic manures apply bonemeal and superphosphate, with the addition of sulphate of potash, as required. As the plants commence to make new growth apply a good spray of winter-strength bordeaux, to which —for the destruction of

raspberry-bud moth and other early prowling larvæ — arsenate of lead should be added at the rate of 1½ lb. to 50 gallons of spray.

TOBACCO.

Some tobacco-growers who are holding a little dried leaf wish to know how to ferment it in a way suitable for smoking. That operation is nowadays usually carried out by the manufacturer, who has apartments where light, heat, and humidity are under control, and where the process is carried out by men of long experience. Small quantities of dried leaf can be fermented in the following manner during the warmer spring weather—say, about the month of September in average districts: The leaf must first be conditioned by admitting or creating a humid atmosphere, when it becomes tough and pliable, although the midrib is still so dry as to crack when doubled over. It may then be stacked in a storeroom on a low platform, with the butts of the hands outwards and the tips overlapping. The stack should be at least 4 ft. or 5 ft. high and any convenient width. When completed, place a few boards on top and cover with a good tarpaulin. The temperature will soon begin to rise, and careful watch must be kept to see that it does not rise much above 100° F. Should it do so the bulk must be broken down, shaken out, and rebuilt. After about three or four weeks of this treatment the tobacco should be ready for storage, and will improve with age up to within certain limits.

Small quantities of dried leaf may be fermented by carefully packing them in a box that is not too airtight. Place the conditioned leaf so that the butts of the hands are towards the outside. Fill the box so that when the lid is screwed on the contents are under moderate pressure. Watch the product for heating, and open up the package, air, and repack it when necessary.

PLANTING OF TREES AND SHRUBS.

We are now in the middle of the short annual planting season for trees and shrubs. Where such work has to be done there should be no delay in obtaining the plants and heeling them in; also in the preparation of the land in which they are to be planted. It is important that the land shall be worked only when dry and friable; also that the plants, when put into their permanent position, shall be inserted to the same depth at which they have previously grown, and planted very firmly.

LAWNS AND GREENS.

Those who have the care of lawns and playing-greens have now an opportunity to repair the wear-and-tear of the past season—that is, unless it was made good during the late autumn. The treatment will probably take the form of some weeding, feeding, top-dressing, and sowing seeds where the turf is inclined to be thin. Great care is needed to see that the loam used for top-dressing and mixing with the fertilizers is sound and free from weed-seeds. The choice of grass-seeds, too, demands careful attention. It is important that they should not only be fine grasses of a permanent character, but also adapted to the soil and locality; and especially must they be free from seeds of weeds and unsuitable unspecified grasses.

—*W. C. Hyde, Horticulturist.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

CONTAGIOUS STOMATITIS IN HOGGETS.

"FARMER," Takaka :—

I am having trouble with a skin-disease among my half-bred hoggets this year. The disease takes the form of small festers or scabs, and is found only around the mouth. Practically the whole mob is affected, some very slightly and others very badly. The flock runs on good, clean, sweet country. Please inform me of the nature of this trouble, and the most effective cure.

The Live-stock Division :—

The disease you describe appears to be contagious stomatitis. This is due to a germ which gains entrance through abrasions on the face and lips of the sheep from thistles or other coarse or prickly herbage. You are advised to put the non-affected sheep on a clean pasture, isolate those affected, and after thoroughly cleansing the affected parts with any mild antiseptic solution apply an ointment consisting of precipitated sulphur, 1 part, and vaseline, 8 parts. This should be used liberally, repeating the treatment after a few days where required.

COWS NOT COMING TO THE BULL.

C. WAY, Ruakaka :—

We have several cows which have not come on to the bull this year—one heifer in particular which has been in for eighteen months and is not now in calf. Could you let me know if the animals can be treated, and, if so, in what way I should go about it ?

The Live-stock Division :—

In cases in which several cows fail to show signs of œstrum, or, in other words, do not come on "bulling," the most common cause is malnutrition, and the remedy will be to provide extra nourishment by means of some concentrated food fed daily. Chaff, crushed oats, and bran are most useful for this purpose, and one or two pounds of linseed cake daily will also have a beneficial effect. In the case of the heifer referred to, the cause may lie in some affection of the ovaries. We have also met with cases of this nature in heifers, due to the presence of a mummified fœtus in the uterus. In such cases, of course, only an actual examination of the animal can determine the exact cause.

INTERPOLLINATING DELICIOUS APPLE-TREES.

H. M. SIMMONDS, Tauranga :—

We have an orchard of ten-year-old apple-trees. Gravensteins and Jonathans are doing well, but Delicious, excepting a few growing next to the Jonathans, are producing only about half a dozen apples per tree. All the trees are healthy and making good growth. Do you think these Delicious require another variety to fertilize them ?

The Horticulture Division :—

The Delicious apple-tree certainly sets a better crop when satisfactorily interpollinated. Where this variety is largely planted growers sometimes inter-plant Dougherty trees or graft pieces of Sturmer wood into the Delicious trees. Another method is to set blossom of another variety of apple in tins of water among the trees when in bloom. If the Jonathan apple is doing the work satisfactorily, and suits your market, it may pay you to extend your planting of it for the purpose of interpollination.

SWELLING ON YOUNG BOAR'S SHEATH.

J. O. K., Matamata :—

I have a young boar with a swelling in shape like an egg at the point of his sheath. Please advise as to what it is, and if it will affect him in his work.

The Live-stock Division :—

The swelling on the boar might be a tumour; and, if so, will in all probability later on affect him in service. The only treatment in this case is removal of the growth by the knife. A swelling is sometimes seen on the sheath of young pigs, due to an injury brought about by the animals rupturing the tissue of this part in endeavouring to feed out of a too high trough. In this case the swelling is usually soft—containing extravasted blood—and is not of a serious nature, an incision with a knife and antiseptic washing being all that is required.

TOP-DRESSING BUSH SHEEP-COUNTRY.

"BACKBLOCKS," Otorohanga :—

We propose to top-dress some sheep bush-country that has been down for twenty-three years and is mostly in danthonia. It was originally tawhero country, with odd rimu and totara among it. What is the best manure to use, and in what quantities? We would sooner use a manure with a lasting effect, if possible. Would basic slag be of any use on this light country?

The Fields Division :—

High-grade superphosphates would probably be the best proposition on country such as you describe. It is the concentrated form of phosphate, and is therefore cheapest to cart and handle, and is comparatively easy to sow. There is no reason to suppose that it will be exhausted any quicker than slag, and its effect in the first season would almost certainly be greater.

PIZZLE-ROT IN WETHERS.

C. SCOTT-MAUNDRELL, Rata :—

Would you please give me some information about pizzle-rot in wethers? I have had trouble with it in long-woolled sheep. Despite the fact that I keep the wool cut I still notice scabs on the part. Is the trouble contagious, and what is the best treatment?

The Live-stock Division :—

This condition of the pizzle is not contagious. It is frequently met with in wethers, particularly those in good order, and occurs more frequently in the autumn and winter, when the feed has lost its succulency and there is an increased amount of urinary solids. In long-woolled sheep it is necessary that the wool be clipped, and where the condition is present the parts washed, the scab removed, and a little sweet oil applied. An ample supply of fresh drinking-water should be available to the sheep.

POISONING WILD PIGS WITH STRYCHNINE.

"INQUIRER," Otautau :—

I shall be obliged for advice as to whether it is possible to poison wild pigs with strychnine, or whether the fern-roots on which they feed act as an antidote.

The Live-stock Division :—

The usual method for poisoning wild pigs with strychnine is to slaughter an old cow or horse on the ground where the pigs are roaming. Skin and open up the carcase and slash the muscles in different parts, then sprinkle the whole with the strychnine. Usually nothing is left by the pigs but the bones, so there is little risk of dogs being poisoned. Fern-root does not act as an antidote.

WEATHER RECORDS: MAY, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during the month of May was remarkable for the number of cyclonic disturbances which passed to the northward of New Zealand, and also for the absence of westerly low-pressure areas. Rainfall was greatly in excess, particularly in the North Island and in the north-east districts of the South Island, but was deficient in Christchurch City and in the west-coast and southern districts of the South Island.

The month opened with stormy weather. On the 6th a disturbance, centered about the Chatham Islands, intensified and caused severe southerly gales along the east coast, the barometer reading 29·46 in. at Chatham Islands, while it was ¾ in. higher in most parts of the Dominion. Anticyclonic conditions followed, but on the 10th a cyclone made its appearance to the northward of New Zealand, causing heavy rain in the North. Further heavy rain was reported about the 14th and 15th, especially in the King-country and northern districts, and a severe thunderstorm was experienced in Auckland at the same time. On the 22nd and 23rd a remarkably steep depression passed over the Dominion and caused wide-spread storm conditions, especially in the North. Floods occurred in Taranaki, the King-country, and other parts; the Auckland Province also experienced gales and heavy rain. Anticyclonic conditions with fair weather prevailed from the 24th to the 28th, but another cyclone then made its appearance in the North, and the month closed with weather which will be remembered for a long time by the northern inhabitants.

—*D. C. Bates, Director.*

RAINFALL FOR MAY, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	9·79	18	3·28	5·06
Russell	10·07	15	4·10	3·53
Whangarei	13·61	20	4·18	6·59
Auckland	5·25	24	1·45	4·41
Hamilton	6·07	18	1·50	4·41
Kawhia	13·52	20	3·60	4·77
New Plymouth	7·14	17	1·84	6·16
Riverside, Inglewood	10·31	15	3·64	9·82
Whangamomona	11·37	12	2·80	6·59
Tairua, Thames	9·26	13	2·20	6·11
Tauranga	8·46	15	4·56	4·88
Maraehako Station, Opotiki	6·16	13	1·74	4·82
Gisborne	4·97	17	1·57	5·50
Taupo	8·79	12	2·36	3·60
Napier	3·59	15	0·84	4·14
Maraekakaho Station, Hastings	4·34	16	1·41	3·52
Taihape	5·76	18	2·00	3·75
Masterton	5·42	23	1·11	3·91
Patea	5·75	16	1·44	3·91
Wanganui	3·54	11	1·14	3·40
Foxton	6·68	12	1·42	2·32
Wellington	6·30	17	0·96	4·74
South Island.				
Westport	3·80	18	0.90	6·58
Greymouth	3·12	14	0·73	8·39
Hokitika	4·94	14	0·81	9·79
Arthur's Pass	12·86	11	5·00	10·93

RAINFALL FOR MAY, 1925—*continued*.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Okuru, Westland	7·28	8	2·02	11·60
Collingwood	4·56	15	0·84	10·18
Nelson	3·70	10	1·04	3·13
Spring Creek, Blenheim	4·91	10	1·50	2·49
Tophouse	4·41	10	1·23	5·46
Hanmer Springs	7·71	14	3·25	3·52
Highfield, Waiau	6·26	10	2·20	2·76
Gore Bay	5·52	11	2·46	3·43
Christchurch	2·12	14	0·75	2·56
Timaru	2·01	10	1·05	1·27
Lambrook Station, Fairlie	2·64	6	0·98	1·28
Benmore Station, Omarama	2·24	11	0·54	1·75
Oamaru	2·64	10	1·28	1·58
Queenstown	0·84	6	0·32	2·71
Clyde	0·54	2	0·30	0·97
Dunedin	2·79	9	1·40	3·20
Gore	1·20	10	0·35	2·84
Invercargill	2·48	15	0·74	4·55

PRICE OF STRYCHNINE AND CARBON BISULPHIDE.

THE Department has again been able to reduce its selling-prices of these materials for rabbit-destruction. Strychnine will now be supplied at 3s. 6d. per ounce; and carbon bisulphide at 40s. per drum of approximately 50 lb., freight paid to nearest railway-station.

FORTHCOMING WINTER SHOWS.

Wanganui A. and P. Association: Wanganui, 24th to 27th June.
Poverty Bay A. and P. Association: Gisborne, 25th to 27th June.
South Taranaki Winter Show Company: Hawera, 30th June to 4th July.
Wellington Winter Show Association: Wellington, 30th July to 15th August.
Auckland Winter Exhibition: Auckland, 15th to 22nd August.

Chair of Agriculture at Auckland.—The Auckland University College has filled its newly constituted Chair of Agriculture by the appointment of Mr. William Riddet, B.Sc., at present lecturer in dairying and assistant dairy research officer at the Dairy School of Scotland, Kilmarnock. Professor Riddet gained most of his practical experience on his father's farm in Ayrshire. He is twenty-nine years of age.

London Market for Peas and Beans.—The following advice was cabled by the High Commissioner on 6th June: *Peas.*—Maple partridge meet small spot inquiry; New Zealand, 62s. to 72s. per 504 lb.; Tasmanian, 72s. to 82s.; value June shipment No. 1 new crops New Zealand, 65s. c.i.f. Blue in better demand; business principally confined to Japanese and small hand-picked Dutch; no business reported in New Zealand and Tasmanian. *Beans.*—Market quiet but firm; English choice spring selling up to 56s., winter 49s., per 532 lb.; Chinese horse, July-September shipments, offered at £10 7s. 6d. per ton landed and £11 5s. ex store.

PRECAUTIONS AGAINST SPREAD OF FIREBLIGHT.

THE regulations under the Orchard and Garden Diseases Act, prohibiting the removal of certain plants and of bees from portions of the Taranaki and Wellington Land Districts, which were gazetted on 30th March, 1922, have been revoked, and the following regulations made in lieu thereof—coming into force on the 28th May, 1925, the date of their gazetting :—

1. In these regulations "prescribed area" means all that area comprising the counties of Patea, Waitotara, and Wanganui.

2. No plant or portion of a plant of any variety of apple, pear, quince, or *Cratægus* shall be sent or brought from the prescribed area into any portion of New Zealand other than that area comprising the Auckland and North Auckland Land Districts: Provided that nothing in this regulation shall apply to the sending by an officer of the Department of Agriculture, under proper safeguards, of plants or portions of plants of any of the above-mentioned kinds from the prescribed area for the purpose of the identification of the disease.

3. (1.) Every package of trees or shrubs, or portions of trees or shrubs, sent from the prescribed area to any portion of New Zealand, other than that area comprising the Auckland and North Auckland Land Districts, must be accompanied by a certificate, in the form set out in the Schedule hereto, signed by the consignor, that no plant or portion of a plant of any variety of apple, pear, quince, or *Cratægus* is contained in the package. (2.) The certificate shall be endorsed on a tag or label securely attached to the package in a prominent position.

4. (1.) No bees shall be sent or brought from the prescribed area to any other portion of New Zealand unless such bees have been effectively quarantined for the six days immediately prior to their despatch from that area so as to prevent their having access to any flowers or other vegetation. (2.) The Director of the Horticulture Division of the Department of Agriculture shall appoint such places of quarantine, and shall prescribe such conditions for their use as he deems necessary. (3.) Before sending or taking any bees out of the prescribed area the owner shall have them quarantined at one of the appointed places of quarantine. (4.) After completing the prescribed period of six days in quarantine the bees shall be forwarded direct from the quarantine place to their final destination, an official permit signed by an officer of the Department of Agriculture being attached by tag or label to each parcel of such bees. (5.) No bees shall be accepted for posting or for consignment by rail to an address outside the prescribed area without such official permit being attached to the parcel. (6.) All expenses of sending bees to a place of quarantine and of forwarding them on completion of their period of quarantine to their destination outside the prescribed area shall be borne by the original sender of such bees, and shall be payable on demand.

5. Every person who does or omits any act in contravention of these regulations commits an offence, and is liable on conviction to a fine not exceeding £2.

SCHEDULE.

CERTIFICATE TO ACCOMPANY PACKAGES OF PLANTS.

I, THE UNDERSIGNED, hereby certify that no plant or portion of plant of any variety of apple, pear, quince, or *Cratægus* is contained in this package.

Date : Signature :

Place : Witness to signature :

Seed-germination Tests.—Facilities for the making of earth tests will shortly be available at the Official Seed-testing Station. These will be charged for (to seed-merchants) at the same rate as germinator tests, except in the case of turnips, swedes, &c., submitted for purity, when an earth test for the detection of wild turnip, or admixture of swede in turnip, and *vice versa*, will be included as part of the purity analysis.

Meat for Nauru Island.—A contract has been secured by one of the Auckland freezing companies for the supply of 4,900 cases of canned meats to the Nauru Island Administration, for the labourers on the phosphate workings. This business, which represents over a year's supply, was secured in competition with Australian firms.

The New Zealand

Journal of Agriculture.

Vol. XXXI.—No. 1.

WELLINGTON, 20TH JULY, 1925.

ACIDITY-REDUCTION IN CREAM FOR BUTTER-MAKING.

THE USE OF BICARBONATE OF SODA.

G. M. Valentine, Dairy Instructor, Auckland.

The reduction of acidity in cream by means of neutralizers was first practised in New Zealand dairy factories after the introduction of the home-separation system of buttermaking. Under the whole-milk system pasteurization had not been generally adopted, but the less frequent deliveries under home separation produced a cream of much poorer quality and higher acidity. It was soon evident that if a high-grade butter was to be made pasteurization was a necessity, and the difficulty of dealing with very sour cream presented itself. The use of an alkali to reduce the acidity of the cream was the next step, and after numerous experiments with lime, carbonate of soda, bicarbonate of soda, mixtures of these, &c., bicarbonate of soda was almost generally adopted. It has many advantages: it is cheap, mild in its action, and is in common use as an ingredient of other food products; but it must be used with discretion, or a strong soda flavour will be imparted to the butter. For the sake of simplicity bicarbonate of soda is hereafter in this article termed "soda."

Cream which has been separated from milk at a skimming-station will show from 0·1 to 0·15 per cent. of acidity. Home-separated cream received daily may run from 0·13 to 0·2 per cent. of acid if handled with reasonable care. Experience has shown that a more uniform quality of butter can be made from such cream by means of pasteurization, and no difficulties will be experienced in putting it

through the machines without the addition of a neutralizer, though in actual practice in New Zealand to-day nearly all cream is partially neutralized.

Sour cream can be pasteurized, but the loss of fat in the butter-milk is considerable, while difficulty will be experienced by curdling, and through the casein burning on the pasteurizer. Moreover, the quality of the butter will be irregular, and, owing to the high acidity, liable to develop "fishiness." Hence the necessity for partial neutralization. On the other hand, the addition of soda solution does not reduce the acidity more than 0·02 or 0·03 per cent. until heat is applied; consequently pasteurization becomes a necessity if high-grade butter of uniform quality is to be made from cream of this class.

The object of partial neutralization of sour cream, then, is to reduce the acidity to the point when the pasteurization process as used with sweet cream may be successfully applied. It should be noted here, however, that such neutralization will not make a clean-flavoured sound-keeping butter from cream in which the acid has developed to the point of staleness, fermentation, rancidity, &c., or which has defects such as feed, dirty milking-machine, or other off-flavours of similar character.

On uniformity of acidity and temperature will depend the success or otherwise of the work done. The whole of the cream treated must be subjected to the same temperature, as a drop in the temperature of the pasteurizer will result in less complete combination between the soda and the lactic acid. Excess of soda in one vat will not compensate for a deficiency in another, even though the cream in the cooling-vats may show the acidity aimed at, for practically the whole of the neutralizing effect takes place in the pasteurizer. If the amount of soda required is only guessed at, a test cannot be made nor any error corrected until a certain quantity of cream has passed through the pasteurizer. This in a large factory, possibly with two pasteurizers and a regenerator, may be quite sufficient to spoil the day's make. When using a neutralizer the tendency is to add too much, and, instead of partial neutralization, the inclination is to make the cream quite neutral, or even to add an excess of soda, which doubtless is the cause of the complaints of neutralizer or preservative flavour so frequently heard of late.

Most factory-managers can recall days on which it seemed impossible to bring down the acidity of the cream, and the more soda was added the higher the acidity rose. Thus, if it was desired to reduce 100 gallons of cream which showed 0·4 per cent. of acid in the receiving-vat to 0·1 per cent. leaving the pasteurizer, 2·5 lb. of soda would be required; but if 4 lb. of soda were added the acidimeter-reading might be 0·15; while if still more soda were added the acidity of the cream would possibly rise to 0·2 instead of being reduced. This was due to the fact that if too much soda is added to the cream the acidimeter-readings are quite unreliable.

A rise in the acidimeter-reading as the result of the presence of too much alkali seems to be contrary to all reason, but experience has shown this to be the case, and any one wishing to satisfy himself on this point can do so in the following manner: Take some cream which has been neutralized to 0·15 (correct reading) and add a pinch of soda. Warm the cream over the spirit-lamp, and then test it for acid. Continue to add soda in small quantities, heating and

testing for acid, and it will be found that the acidimeter-readings gradually fall; then as the amount of soda present becomes excessive they will rise again to over 0·2 per cent. Now take some sour cream to which no soda has been added, and add a little at a time to the cream containing the excess of soda. Heat and test as before, and the acidimeter-readings will gradually fall and then rise again.

The presence of too much soda can be detected by a bitter taste in the pasteurized cream, by the pasteurizer boiling over, by the appearance of innumerable small bubbles in the cream passing over the cooler, or by the formation of a pink ring immediately the indicator is dropped into the sample to be tested. If the excess is slight this ring will disappear when the cup is shaken, but if the excess of soda is considerable the pink colour will remain permanent without the addition of any alkaline solution.

In order to maintain an even percentage of acidity in the pasteurized cream it is necessary to have two receiving-vats, or one vat divided into two sections. Cases can be quoted where good work has been done with only one vat, but it is much more difficult to keep the acidity uniform, and there is more danger of using an excess of soda. Round-bottomed neutralizing-vats similar in shape to the ordinary expansion cream-vat will be found most suitable. Their shape makes the mixing of the cream for sampling and the mixing of the soda solution into the cream much easier. Where the height of the receiving-platform allows one vat to be placed above another the top one can be used for neutralizing, and the drop from it to the bottom one will thoroughly mix the cream and soda solution. Experience has shown it to be good practice to have these vats of such size that they will be emptied in about thirty minutes.

A good plan is to fill the receiving-vat to a mark a few inches below the top, the quantity which it holds to that point having been previously ascertained. This will allow room for the cream to swell after the soda is added. Thoroughly stir the cream, so that a representative sample can be taken, and then test for acidity. Assuming that the acidity is 0·5, and it is desired to reduce it to 0·1, the following calculation will give the amount of soda required for a vat of 1,500 lb. of cream. Subtract the degree of acidity desired—namely, 0·1—from the acidity reading of the cream in the vat (that is 0·5 per cent.), and we have 0·4 per cent. of acidity to be taken out, proceeding thus—

$$\frac{1{,}500 \times 0{\cdot}40 \times 1}{1{,}000 \times 0{\cdot}12} = 5 \text{ lb. of soda required.}$$

The table on the next page gives the amount of soda required to reduce practically any quantity of cream any number of points. It is not claimed that it is correct under all conditions, this being chiefly owing to the variation in the strength of soda, but it is so close that if used in conjunction with the acidimeter no overdosing with soda is likely.

Careful experiment with cream ranging from 0·2 to 0·7 per cent. of acidity has shown that 1 lb. of Crescent brand soda (the brand most commonly used) will reduce the acidity of 1,000 lb. of cream 0·12 per cent., and the table has been calculated from these figures. The first column in the table represents the number of pounds of cream to be utilized. *The top line is the percentage of acidity to be taken out of the cream, not the acidity of the cream in the vat.* To find the number

Acidity-reduction Table for Cream.

Pounds of Cream.	Percentage of Reduction desired.												
	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.22	0.24
	Pounds of Bicarbonate of Soda required.												
500 ..	0.41	0.46	0.50	0.54	0.58	0.62	0.66	0.70	0.75	0.79	0.83	0.92	1.00
600 ..	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.10	1.20
700 ..	0.58	0.64	0.70	0.75	0.81	0.87	0.93	0.99	1.05	1.10	1.16	1.28	1.40
800 ..	0.66	0.73	0.80	0.86	0.93	1.00	1.06	1.13	1.20	1.26	1.33	1.46	1.60
900 ..	0.75	0.82	0.90	0.97	1.05	1.12	1.20	1.27	1.35	1.42	1.50	1.64	1.80
1,000 ..	0.83	0.91	1.00	1.08	1.16	1.25	1.33	1.41	1.50	1.58	1.66	1.83	2.00
1,100 ..	0.91	1.00	1.10	1.19	1.28	1.37	1.46	1.55	1.65	1.74	1.83	2.00	2.20
1,200 ..	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40
1,300 ..	1.08	1.19	1.30	1.40	1.51	1.62	1.73	1.84	1.95	2.05	2.16	2.38	2.60
1,400 ..	1.16	1.28	1.40	1.51	1.63	1.75	1.86	1.98	2.10	2.21	2.33	2.56	2.80
1,500 ..	1.25	1.37	1.50	1.62	1.75	1.87	2.00	2.12	2.25	2.37	2.50	2.74	3.00
1,600 ..	1.33	1.46	1.60	1.73	1.86	2.00	2.13	2.26	2.40	2.53	2.66	2.92	3.20
1,700 ..	1.41	1.55	1.70	1.84	1.98	2.12	2.26	2.40	2.55	2.69	2.83	3.11	3.40
1,800 ..	1.50	1.65	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	3.00	3.30	3.60
1,900 ..	1.58	1.74	1.90	2.06	2.21	2.37	2.53	2.69	2.85	3.00	3.16	3.58	3.80
2,000 ..	1.66	1.83	2.00	2.17	2.33	2.50	2.66	2.83	3.00	3.16	3.33	3.66	4.00
3,000 ..	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.50	6.00
4,000 ..	3.33	3.66	4.00	4.33	4.66	5.00	5.33	5.66	6.00	6.33	6.66	7.33	8.00
5,000 ..	4.16	4.58	5.00	5.41	5.83	6.25	6.66	7.08	7.50	7.91	8.33	9.16	10.00

Pounds of Cream.	Percentage of Reduction desired.												
	0.26	0.28	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.46	0.48	0.50
	Pounds of Bicarbonate of Soda required.												
500 ..	1.08	1.16	1.24	1.33	1.41	1.50	1.58	1.66	1.75	1.84	1.91	2.00	2.08
600 ..	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50
700 ..	1.51	1.62	1.74	1.86	1.98	2.10	2.21	2.33	2.45	2.56	2.68	2.80	2.91
800 ..	1.72	1.86	2.00	2.12	2.26	2.40	2.52	2.66	2.80	2.92	3.06	3.20	3.33
900 ..	1.95	2.10	2.25	2.40	2.55	2.70	2.84	3.00	3.15	3.28	3.45	3.60	3.75
1,000 ..	2.16	2.32	2.50	2.66	2.83	3.00	3.16	3.32	3.50	3.64	3.83	4.00	4.16
1,100 ..	2.38	2.56	2.75	2.92	3.11	3.30	3.48	3.66	3.85	4.03	4.20	4.40	4.58
1,200 ..	2.60	2.80	3.00	3.20	3.40	3.60	3.80	4.00	4.20	4.40	4.60	4.80	5.00
1,300 ..	2.80	3.02	3.25	3.46	3.68	3.90	4.11	4.32	4.55	4.76	4.98	5.20	5.41
1,400 ..	3.03	3.26	3.50	3.73	3.98	4.20	4.42	4.66	4.90	5.12	5.36	5.60	5.83
1,500 ..	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.25
1,600 ..	3.46	3.72	4.00	4.26	4.52	4.80	5.06	5.32	5.60	5.86	6.13	6.40	6.66
1,700 ..	3.68	3.96	4.25	4.52	4.81	5.10	5.38	5.66	5.95	6.23	6.51	6.80	7.08
1,800 ..	3.90	4.20	4.50	4.80	5.10	5.40	5.70	6.00	6.30	6.60	6.90	7.20	7.50
1,900 ..	4.11	4.43	4.75	5.06	5.38	5.70	6.01	6.33	6.65	6.96	7.28	7.60	7.91
2,000 ..	4.33	4.66	5.00	5.33	5.66	6.00	6.32	6.66	7.00	7.32	7.66	8.00	8.33
3,000 ..	6.50	7.00	7.50	8.00	8.50	9.00	9.50	10.00	10.50	11.00	11.50	12.00	12.50
4,000 ..	8.66	9.33	10.00	10.66	11.32	12.00	12.66	13.33	14.00	14.66	15.33	16.00	16.66
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

of pounds of soda required, subtract the acidity desired from the acidity of the cream in the receiving-vat, then follow along the line opposite the number of pounds of cream in the vat until the column under the percentage of acidity to be taken out is reached. For example, as already shown, the reduction of 1,500 lb. of cream from 0·5 to 0·1 will require 5 lb. of soda.

With vats having a holding-capacity which is a multiple of twelve the calculation of the soda required is simple. Since 1 lb. of soda reduces the acidity of 1,000 lb. of cream 0·12 per cent., 1 lb. of soda will reduce the acidity of 1,200 lb. of cream 0·1 per cent. Therefore, by subtracting the acidity desired from the acidity of the cream in the vat the number of pounds of soda required for 1,200 lb. of cream will be found by multiplying this difference by ten

Example.

Cream in Vat.	Acidity of Cream.	Acidity desired.	Calculation.	Soda required.
lb.	Per Cent.	Per Cent.		lb.
1,200	0·50	0·10	0·5 — 0·1	4·0
1,200	0·43	0·06	0·43 — 0·06	3·7
2,400	0·50	0·10	0·5 — 0·1 × 2	8·0
3,600	0·43	0·06	0·43 — 0·06 × 3	11·1

Unless care is taken the acidity-reduction table will not be of much value. The quantity of cream must be known to a few pounds. It must be thoroughly mixed so that the sample tested is representative of the whole. The test should be properly made, and the soda weighed correctly and completely dissolved. The soda solution must be carefully stirred into the cream. To get the weight of cream correct, add up the suppliers' dockets as the cream is being weighed in, and put a mark on the vat for each 100 lb. added. For mixing, nothing is better than a wooden plunger with a big head, or a wooden paddle. Metal plungers knock the tin off the vat.

The practice of adding so many pounds or measures of soda to each vat without having first tested for acidity is quite wrong, as the variation from one vat to another, and from day to day, is too great to give accurate results. A number of factories to-day reduce the acidity of the cream below 0·1, and not infrequently 0·05 or less is the point aimed at. For example, taking 1,500 lb. of cream as before, and 0·5 as the acidity of the cream when received, 5½ lb. of soda will be required to reduce it to 0·05. To reduce the whole of the acidity in the cream to neutral, only 6¼ lb. of soda would be required. Hence the necessity for accurate weighing. For this purpose a spring balance should be provided and used.

When testing sour cream for acidity greater care is necessary than when testing milk or whey, owing to cream being much thicker. Always rinse the pipette with water (the quantity does not matter) to remove the portion adhering to the inside, otherwise a low-acidity reading will result, and consequently a wrong calculation of the amount of soda required This is one of the causes of the common impression that very sour cream requires more soda in proportion than cream which is comparatively low in acid.

Equal care in sampling is necessary to get correct results after the cream has passed through the pasteurizer, owing to the presence of bubbles at this stage. For this reason it is best to catch some cream in a mug, preferably from the last cooler, and allow it to stand a moment before drawing the sample.

A common mistake among buttermakers when making the test for acidity is to work to a shade of pink which is too deep. As laid down in the Department's Bulletin No. 10, "The Acidimeter and its Use," the reading should be taken immediately the pink colour shows an inclination to remain permanent. In point of fact, the mixture at this stage is slightly alkaline, since the phenolphthalien indicator shows pink in the presence of an alkali. If the shade of pink is carried to the point where 0·5 cream is read as 0·52 the result will be that ¼ lb. more soda will apparently be required to every 1,500 lb. of cream. But if the same shade is used in testing for acidity subsequent to pasteurization, cream which is actually neutral may show 0·05 of acid.

With a good indicator two drops should be quite sufficient, and when the first of the alkaline solution is dropped into the cream after the indicator has been added it should show a deep pink before being shaken. If the pink at this stage is pale and undecided the indicator is weak and unreliable, and should be replaced. A drop or two extra will not affect the result, provided the cup is thoroughly shaken, but the pink colour will show more rapidly. Poor indicator will be liable to give a high reading, as more alkaline solution than necessary will have to be added to produce the pink colour. One of the causes of defective indicator is acidity in the alcohol in which the phenolphthalien is dissolved. To correct this defect make a strong solution of caustic soda and water, and drop it into the indicator, one drop at a time, until a slightly pink shade of colour is produced.

To secure accurate results it is necessary to thoroughly dissolve the soda, and since it is practically impossible to do so with cold water it is best to use water at a temperature of about 120° F. The impression is common among factory-managers that the soda is not so strong when dissolved in warm water, but this is not correct. Water so hot that it causes the soda to effervesce is not desirable. A mixture of soda and water in which the soda is held in suspension but not dissolved is not satisfactory, and the small lumps of soda will be found undissolved on the bottom of the vat when it is emptied. Soda solution may be prepared ready for use by dissolving 1 lb. of soda in 9 lb. water: 10 lb. of the solution can then be used instead of 1 lb. of dry soda. In many ways this is more convenient, and time can be taken to see that the soda is thoroughly dissolved. It is best to keep the solution in a wooden barrel, as it attacks any metal vessel and gets a metallic taste. For the same reason a wooden bucket is better than a metal one for dissolving the soda.

Finally, every care should be taken to thoroughly mix the soda solution and the cream in the neutralizing-vats. Here again very thick, sour cream will present the greatest difficulty, and to ensure correct results at least 1 gallon of water to 1 lb. of soda should be used when each lot is being prepared as required. If the cream is very thick this amount of water can be doubled or trebled with advantage.

All final acidimeter-readings of neutralized cream here mentioned were taken as the cream left the pasteurizer after being treated to 200° F. or over, the pasteurizing temperature having a direct influence on the amount of soda required. It has already been stated that there is very little chemical action between the soda and the lactic acid present in the cream until heat is applied. The acidity of the cold cream in the receiving-vats is only reduced a few degrees when the soda is added. If for any reason the pasteurizing cannot be proceeded with for a number of hours after the soda is added it will be found necessary to add nearly as much soda as was used in the first instance, in order to make the desired reduction in the acid when the pasteurizer is started later on. The completeness of the chemical combination between the soda and the lactic acid depends to a great extent on the pasteurizing temperatures. Cream which has been overneutralized may go through the first pasteurizer without showing any indication of excess soda, but on reaching the second and coming into contact with the higher temperature it may "boil over," indicating that the increased heat has stimulated the chemical action between the lactic acid and the soda. Where cream containing 0·4 per cent. or more of acid is being treated under the two-stage system of continuous pasteurization, and the temperature is raised to 170°–180° in the first pasteurizer and to 200° in the second, an acid test from the first machine may show 0·15 per cent. of acid, while the same cream after passing through the second machine shows only 0·08 per cent. If the temperature of the first machine is raised to 190° the difference will probably be only 0·03 or 0·04 per cent. For this reason the fairly general practice of high pasteurizing temperatures for the treatment of partially neutralized cream of high acidity may be accepted as sound.

When treating comparatively sweet cream of about 0·25 per cent. of acid there will not be the same difference between the acidity of the first and second pasteurizers. In other words, the soda acts more freely at the lower pasteurizing temperatures when only a small quantity is required to bring the acidity of the cream down to a certain point. At a temperature of 175° on the first machine and 200° on the second there will be a difference of about 0·04 in the acidity, and if the temperature of the first machine is raised to 190° it will be a point or two less. The difference in the acidity of the two pasteurizers will be greatest with all classes of cream when a very low percentage of acid in the neutralized cream is aimed at.

This goes to show that when pasteurizing sour cream at comparatively low temperatures a certain amount of the soda is not made use of; further, that if the full neutralizing effect of the soda used is to be secured very high pasteurizing temperatures are necessary when treating very sour cream, more especially where a low percentage of acid is aimed at; and lastly, that if a very low neutralizing-point is not aimed at with comparatively sweet cream a high pasteurizing temperature is not necessary to get the full effect of the soda used.

The use of a neutralizer is only necessary owing to defects in the cream, and, as the risks attending its use increase as the quality of the cream gets poorer, an improvement in the quality of the latter should be the aim of every one connected with the butter industry.

While neutralization has undoubtedly done a great deal to improve the quality of the butter made from home-separated cream, it is an open question whether this improvement has not been taken advantage of to accept cream which was not the best that the dairyman was capable of supplying. Further, it is probable in many cases that the greatest improvement possible from acidity-reduction has not been obtained owing to the very common fault of overneutralization. The tenth normal alkaline method of testing for acidity may not be scientifically correct as a test for acid in cream, but commercially it is quite satisfactory. Whether it will show the acidity correctly in cream neutralized to 0·05 per cent. and under is doubtful, since it is possible to get a reading of 0·05 per cent. in cream which is obviously overneutralized, and still get the same reading after a good deal more sour cream has been added to the receiving-vat. Keeping in mind the fact that the acidimeter will not give a correct reading when cream is overneutralized, it is obvious that if a low acidity is aimed at the most careful calculation of the acidity to be removed must be made, since no reliable check-test can be made after the cream has passed through the pasteurizer.

It is also doubtful whether butter can be made from cream which has been neutralized with soda without showing traces of soda. The test for soda in butter is as follows: Weigh out 10 grammes of butter; melt in 100 cc. of warm water; allow mixture to stand five minutes; draw off water into an aluminium mug; add 2 cc. of phenolphthalien indicator which is free from acid; boil over a lamp till a pink colour appears; neutralize the pink colour by dropping in standard acid, as used for testing alkaline solution, from a burette marked to $\frac{1}{20}$ cc.; keep on boiling and adding standard acid till no more colour appears. Note the amount of acid required to reduce the pink colour, and multiply by 0·084. This gives the amount of soda in the butter. Thus, if the acidimeter-reading is 0·25—that is, $\frac{5}{20}$—the soda content of the butter will be $0{\cdot}25 \times 0{\cdot}084 = 0{\cdot}021$ per cent. This test will not give correct results with butter containing preservative other than pure boracic acid.

Before starting to make the test one should make sure that the water and vessels to be used contain no alkali. Fill the mugs with water, add the indicator, and boil. If no pink colour shows, test the water for acidity by dropping in alkaline solution. Condensed water from a steam-valve or from the exhaust of the pasteurizer, if free from oil, will usually be found quite suitable. If no 100 cc. measure is available, six 17·6 cc. pipettes full will be fairly correct, and when removing the watery fluid five pipettes can be drawn without disturbing the fat if no separatory funnel is on hand. Use the factor 0·095 in this case.

If the cream from which the butter was made has been over-neutralized, a strong pink colour will show as soon as the indicator is added to the watery fluid. If it does not do so the solution should be boiled. So far the writer has not tested one sample of butter made from soda-neutralized cream which, out of a large number of samples tested, did not show a soda reaction. Just where the line of distinction showing overneutralized butter can be drawn has not yet been determined, but sufficient has been ascertained to indicate that such a line can be fixed, provided the butter contains no preservative or pure boracic acid only.

GOATS AND BLACKBERRY-CONTROL ON HILL COUNTRY.

NOTES ON MANAGEMENT IN WAIMEA COUNTY.

E. J. FAWCETT, M.A. (*Cambridge*), *Assistant Instructor in Agriculture, Hastings.*

GOATS have been farmed in Waimea County (Nelson District), solely for use in the control of blackberry, since 1906. The results obtained by their owners have clearly demonstrated that at present these animals are the most economical agents known for combating the pest. The farm of Mr. L. Higgins, Belgrove, is an excellent example of their efficiency. Prior to 1906 the late Mr. P. Higgins, who then owned this farm, employed every year two men for about six weeks to cut

FIG. 1. ANGORA GOATS AMONG BLACKBERRY ON MR. L. A. HIGGINS'S FARM, BELGROVE.

blackberry on a 500-acre block. He then purchased a hundred goats, and this flock has been maintained ever since on the area. Since 1906 the blackberry has never been cut, and, in fact, is no longer a menace. The same excellent results have been obtained by other owners throughout the country.

THE ANGORA BREED.

The goats used in Waimea County are as near purebred Angora as can be obtained. The advantages of this breed may be stated as follows: (1.) The average Angora will clip about 5 lb. of wool, which brings approximately the same price as crossbred-sheep wool. (2.) It is, if anything, a more herbaceous-feeding animal than the crossbred. Disadvantages of the Angora are: (1.) The hoggets, owing to their long wool and light frame, are liable to get entangled, resulting in a higher death-rate. (2.) The nannies are more sensitive, and if disturbed immediately after kidding will leave the kid and seldom return. The latter observation applies more or less to all nannies,

and owners should be careful not to disturb them until the kids are at least a week old.

Angoras begin to shed their wool early in spring, and therefore must be shorn then to save loss. On this account they cannot be shorn in cold countries.

BREEDING PRACTICE.

One billy will serve about forty nannies. It is not wise to have too many billies, as they are apt to injure nanny hoggets. To get the best results, billies should be used in exactly the same manner as rams—that is, they should be isolated, and put out with the flock not earlier than May. The gestation period for goats is about 156 days, and care should be taken to ensure that kidding takes place not earlier than September, as young kids do not stand up to the cold well. If billies are allowed to run indiscriminately with the nannies a high death-rate is likely to be experienced from this cause.

FENCES.

One of the first essentials is to have the property well fenced. The best results from the use of goats are undoubtedly obtained on farms sufficiently subdivided to enable goats to be rotated and held on any desired area. Good work may be done, however, by allowing the animals greater freedom in cases where the blackberry is in isolated patches. An excellent example of this is to be seen on the farm of Mr. B. Griffiths, Wai-iti, where, on one block of 190 acres, thirty goats are completely controlling isolated patches.

It is not necessary that special fences be provided for the goats. A well-constructed seven-wire sheep-proof fence is sufficient if care be taken to see that there are no hollows under the bottom wire.

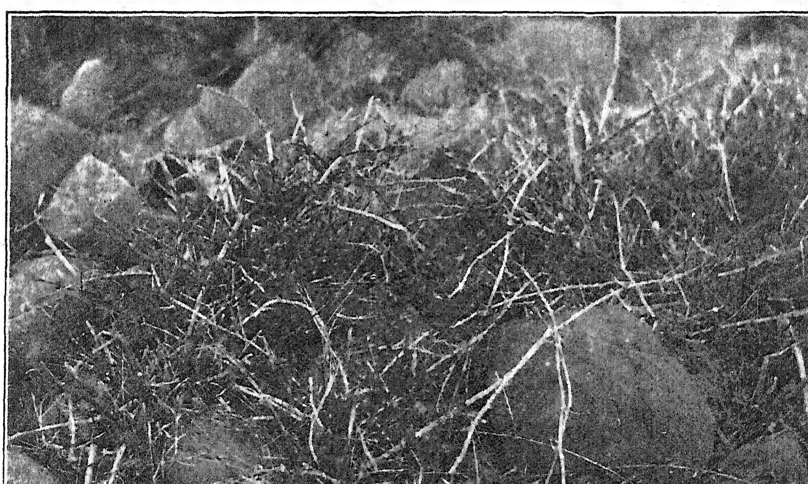


FIG. 2. EXAMPLE OF WORK OF GOATS ON ISOLATED BLACKBERRY ON THE FARM OF MR. B. GRIFFITHS, WAI-ITI.

This bush is very old, and at one stage covered a considerable area, but in its present state is no longer a menace.

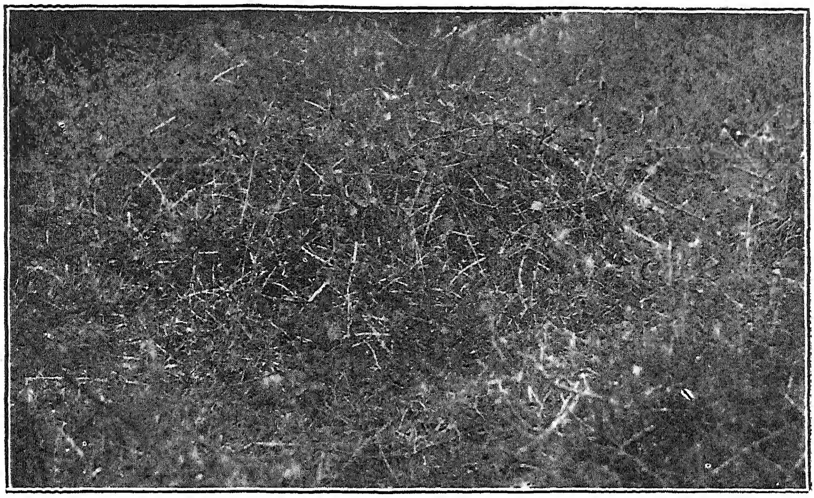


FIG. 3. A VERY DENSE BUSH, AT ONE TIME IMPENETRABLE AND STANDING 5 FT. HIGH.

It will be noticed that tracks are being formed through the bush, and grass is gradually establishing. In a comparatively short time this area will be opened so that sheep can graze it without danger of becoming entangled.

FIG. 4. ANOTHER EXAMPLE OF A DENSE ISOLATED BUSH 5 FT. HIGH, SHOWING HOW GOATS ARE GRADUALLY BREAKING IN FROM THE EDGE.

The fence-line should be cleared, so that no stumps or logs are left as jumping-off places for the animals. It is impossible to prevent kids from straying, but they will always return if their mothers are confined.

CONDITION OF BLACKBERRY MOST SUITABLE FOR GOATS.

It would appear that goats prefer the secondary shoots and growing tips of old runners, rather than the young juicy shoots such as make their appearance after old blackberry is burnt. It has been noticed that when the whole area has been burnt the young growth, especially in spring, will get away from the goats. As the season advances, and the shoots harden up, the goats will return to the attack and get the plant under control again. Having observed this characteristic of the animal, some farmers refrain entirely from burning, relying wholly on goats to crush the blackberry even on newly acquired country overrun with the pest. If this course is adopted it stands to reason that a considerable number will be required per acre to be effective in a reasonable time.

The most economical method is to burn, thus reducing the feed available to goats. Even though the young growth is not so palatable, it will be found that blackberry can be kept under control by a comparatively small flock under these conditions. At the same time the block being treated should be stocked fairly heavily with sheep in order to keep down the grass, in this way preventing the goats from feeding on that which might otherwise be the more easily procured fodder.

SUMMARY.

In Waimea County farmers are endeavouring to breed pure Angoras, as they are considered a better herbaceous-feeding animal than the crossbred, and the returns from Angora wool more than compensate for losses of stock. The use of goats has entirely superseded cutting on those farms where given a trial. In order to obtain maximum results good fences are essential, so that goats may be confined on any area at the discretion of the farmer. Billies should be isolated after serving the nannies, in exactly the same manner as rams are removed from ewes. On the whole it is better to burn the blackberry, using sheep in conjunction with goats. It is idle to suggest that goats never eat grass, but they undoubtedly prefer fibrous matter, and by controlling the growth of grass with sheep the goats have not the same opportunity of cultivating a taste for grass, and are therefore compelled to eat blackberry and other rubbish with greater avidity. Although never definitely tested, it is the firm conviction of goat-owners that the sheep-carrying capacity of their land is increased by the judicious use of these animals.

FARMS VISITED.

In the course of the brief survey on which these notes are based the following farms were visited: B. Griffiths, Wai-iti—farming 190 acres of scattered blackberry country with thirty goats. Mrs. S. Griffiths, Wai-iti—farming 350 acres of dense blackberry country with 150 goats. L. Higgins, Belgrove—farming 600 acres; 50 acres dense blackberry country, remainder scattered; 150 goats. C. Higgins, Belgrove—for one year has had twenty-nine goats on 15 acres of practically impassable blackberry. Fawcett Bros., Tadmor—have recently been farming 150 acres of dense blackberry with eighty goats.

STANDARDIZED RULES FOR JUDGING SHOW FRUIT.

AMENDED LISTS AND SCORE-CARDS.

J. A. CAMPBELL, Director of the Horticulture Division.

IN the year 1917, on the motion of the annual fruitgrowers' conference held at Dunedin, an attempt was made to overcome the principal factors militating against the satisfactory judging of fruit exhibits at the various horticultural and agricultural shows throughout the Dominion. The recommendations of the committee set up by the executive of the New Zealand Fruitgrowers' Federation for the purpose of giving expression to the wishes of the conference in the matter were published in the September, 1917, issue of this *Journal.*

The idea was not necessarily to devise perfect rules and conditions that would be approved by all — the varied opinions on the subject rendering the latter impossible—but rather to place on record something concise on the subject, working on the principle that, while possibly not perfect in every detail, standard rules of the kind, particularly when supported by judging-cards fixing the maximum value of the different features of an exhibit, would not only tend towards greater uniformity among judges, but would be of very great value to exhibitors in the preparation and selection of their exhibits.

The 1917 recommendations on the subject have in the meantime been generally adopted and appreciated as an improvement by all concerned. Experience, however, has suggested that a few minor alterations are necessary, and with this in view the Federation has again taken up the matter. On behalf of that organization the following is therefore submitted and recommended for adoption by all societies interested in fruit exhibitions :—

Apples for show purposes are divided into two classes—dessert and culinary ; but approved dessert varieties may be allowed to compete in culinary classes. Both classes are divided into two types—commercial and exhibition. The standard sizes of apples of exhibition and commercial types of both dessert and culinary classes are those sizes set against the various varieties listed hereafter. In the case of cooking-apples for exhibition type the margin of $\frac{1}{8}$ in. above and below the standard size is allowed, but in all other cases the margin allowed is $\frac{1}{16}$ in. All fruit having a greater discrepancy from the standard size than the margin allowed is to be penalized at the discretion of the judge ; any exhibit comprising fruit of a greater discrepancy than $\frac{1}{8}$ in. above or below the margin provided is to be disqualified.

Naming : Misnaming in plate and single-case entries disqualifies the entry, and misnaming in connection with collection and case entries warrants disqualification ; but such errors may, at the discretion of the judge, be met by a deduction in the total number of points, if in his opinion the incident of misnaming is of minor importance. In the event of disqualification not applying, such deduction is to be not less than 3 and not more than 6 points.

Condition : In judging for condition consideration is to be given to the purpose of the fruit at the time of judging. The aim for a plate of dessert apples or pears should be prime condition for dessert purposes when being judged, and points awarded accordingly.

Market value: The popularity of the variety on the New Zealand markets, together with the condition of the fruit exhibited, is to be the standard of value for allotting points.

DESSERT APPLES.—STANDARD SIZES.

Following is a list of varieties of dessert apples with respect to which $\frac{1}{16}$ in. margin above and below the standard size is allowed. The sizes of varieties not enumerated to be at the discretion of the judge.

Variety.	Exhibition.	Commercial.	Variety.	Exhibition.	Commercial.
	Inches.	Inches.		Inches.	Inches.
Adams Pearmain ..	3	2⅝	King of Pippins ..	3	2⅝
Allington Pippin ..	3	2⅝	London Pippin ..	3⅜	2⅞
American Golden Russet	2⅞	2⅝	McLiver's Winesap ..	3	2⅝
American Horn ..	2⅞	2⅝	Northern Spy ..	3⅛	2⅞
Beauty of Bath ..	3	2⅝	Parlin's Beauty ..	3¼	2⅞
Blenheim Orange .	3	2⅝	Pioneer	3	2⅝
Boston Russet ..	3	2¾	Premier	3⅛	2⅞
Brownlee's Russet ..	3	2¾	Red Astrachan ..	3⅛	2¾
Carlton .. .	3	2¾	Ribston Pippin ..	3	2⅝
Charles Ross.. ..	3⅛	2¾	Rokewood	3	2⅝
Cleopatra .. .	3¼	2¾	Rome Beauty ..	3⅜	2⅞
Commerce	3	2¾	Salome	3	2¾
Cornish Aromatic ..	3⅛	2¾	Scarlet Pearmain ..	2⅞	2⅝
Cox's Orange Pippin ..	3	2⅝	Scarlet Nonpareil ..	3	2⅝
Delicious	3¼	2¾	Scarlet Queen ..	3	2⅝
Dougherty	3	2⅝	Senator	3	2⅝
Duke of Clarence ..	3⅛	2¾	Shepherd's Perfection..	3	2¾
Dunn's Favourite ..	3⅜	2¾	Stark	3	2¾
Edward Lippiatt ..	3	2¾	Statesman	3⅛	2¾
Esopus Spitzenberg ..	3¼	2¾	Stayman Winesap ..	3¼	2¾
Frimley Beauty ..	3¼	2⅞	Sturmer	3⅛	2¾
Gem	3⅛	2⅞	Tasma	3⅜	2⅞
Golden Pippin ..	3	2⅝	William Anderson ..	3	2⅝
Golden Reinette ..	3	2⅝	Willie Sharp	3⅛	2⅝
Gravenstein	3¼	2⅞	Worcester Pearmain ..	3	2⅝
Jonathan	3	2⅝	Yellow Newtown Pippin	3	2⅝
King David	3	2⅝			

COOKING-APPLES.—STANDARD SIZES.

Following is a list of varieties of cooking-apples with respect to which ⅛ in. margin above and below the standard size is allowed. The sizes of varieties not enumerated to be at the discretion of the judge.

Variety.	Exhibition.	Commercial.	Variety.	Exhibition.	Commercial.
	Inches.	Inches.		Inches.	Inches.
Alfriston	3½	3	John Bull	3¼	3
Ballarat	3⅝	3	London Pippin ..	3⅜	3
Blenheim Orange ..	3⅛	2⅞	Lord Suffield.. ..	3⅜	3
Cleopatra	3¼	2⅞	Lord Wolseley ..	3¼	2⅞
Commerce	3¼	2⅞	Mobb's Royal ..	3½	3
Delicious	3½	3	Northern Spy ..	3⅜	3
Dumelow	3¼	3	Parlin's Beauty ..	3½	3⅛
Dunn's Favourite ..	3½	3⅛	Pioneer	3¼	2⅞
Emperor Alexander ..	3¾	3⅛	Pride of Australia ..	3¼	2⅞
French Crab	3⅛	2¾	Prince Alfred ..	4	3¼
Gloria Mundi ..	3¾	3⅛	Premier	3½	3⅛
Hoover	3¼	3	Reinette du Canada ..	3½	3⅛

COOKING-APPLES—*continued.*

Variety.	Exhibition.	Commercial.	Variety.	Exhibition.	Commercial.
	Inches.	Inches.		Inches.	Inches.
Rhode Island Greening	$3\frac{1}{4}$	$2\frac{7}{8}$	Stone Pippin	$3\frac{1}{8}$	$2\frac{3}{4}$
Rokewood	$3\frac{1}{8}$	$2\frac{7}{8}$	Sturmer	$3\frac{1}{4}$	$2\frac{7}{8}$
Rymer	$3\frac{1}{4}$	3	Tasma	$3\frac{1}{2}$	3
Sharp's Late Red ..	$3\frac{1}{4}$	3	Washington	$3\frac{1}{4}$	$2\frac{7}{8}$
Springdale	$3\frac{1}{4}$	$2\frac{7}{8}$	Yellow Bellefleur ..	$3\frac{1}{4}$	$2\frac{7}{8}$

SCORE-CARDS.

Apples, Single Plate Lots.—Dessert.

	Points.
Size and uniformity	15
Form	5
Flavour and condition	30
Colour and appearance.. ..	35
Freedom from blemish.. ..	15
	100

Apples, Single Plate Lots.—Cooking.

	Points.
Size and uniformity	15
Form	5
Condition and cooking-quality ..	40
Colour and appearance.. ..	25
Freedom from blemish.. ..	15
	100

Apples, Collection of Plates.—Dessert.

	Points.
Size and uniformity	15
Form	5
Flavour and condition	20
Colour and appearance.. ..	25
Market value	20
Freedom from blemish.. ..	15
	100

Apples, Collection of Plates.—Cooking.

	Points.
Size and uniformity	15
Form	5
Condition and cooking-quality ..	30
Colour and appearance.. ..	15
Market value	20
Freedom from blemish.. ..	15
	100

Pears, Collection and Plates.

	Points.
Form, size, and uniformity	15
Quality and flavour	25
Condition and appearance ..	20
Market value	20
Freedom from blemish.. ..	20
	100

Pears, Cases.

	Points.
Form and size	10
Storage, transportation, and market value	20
Condition, quality, and appearance	20
Uniformity of sizing and grading	20
Wrapping, height, alignment, and compactness	25
General appearance of package ..	5
	100

Provincial District Exhibits.

	Points.
Variety of exhibit	15
General artistic effect	15
Quality of exhibits	30
Commercial value	30
Educational value	10
	100

COMMENTS.

Size and Uniformity.—Correct size is quite an important factor, but the provision in the rules previously in force for a penalty of 2 points for every $\frac{1}{16}$ in. in any specimen forming part of an exhibit that was found to be above or below the margins allowed was found impossible to apply in instances where a number of apples were at fault, and at best caused more labour in carrying out accurate measurements than the position warranted. Under the present conditions the judge is left a free hand to fix the penalty, the determining of the standard sizes, together with the provision for disqualification in the event of any fruit of an exhibit being in excess of $\frac{1}{8}$ in. above or below the margins allowed, being held to be a sufficient safeguard. Uniformity has to do with evenness of sizing, shape, colour, and maturity.

Form.—Form has been substituted for typical form, for the reason that typical form is difficult to determine, judges having different views on the subject. Moreover, typical form is often embarrassing to the judge; he, having declared a form with respect to a variety, often finds it difficult to maintain that form when judging further fruits of the same variety. In any case, he frequently fails to do so, causing his judgment in this connection to be inconsistent. It is reasonable to hold that apples of really good shape of any variety should serve that variety well on the show table, but there should be some means of penalizing apples of an objectionable shape. This cannot be relied upon under the heading of "uniformity," as the exhibit may be quite uniform although objectionable in shape. A few points only have been allowed under this heading, but, if necessary, a further deduction may be made under the heading of "appearance" if the objectionable form seriously affects the appearance of the fruit.

Flavour and Condition.—Condition must be taken into account, and also flavour. Arguments are sometimes raised against flavour, as it is held that to determine it fruits must be cut and tasted by the judge, such action frequently spoiling an excellent exhibit required for other shows. Cutting should be practised to a limited extent only. Apples of the same variety and of the same appearance and condition should be given round about equal points for flavour, the judge determining what state of maturity, in his opinion, would give maximum flavour, and judging accordingly.

Colour and Appearance.—It will be noticed that "appearance" has been added to "colour," as it is held that the former will widen the position for the judge, and thereby enable him to express his opinion of an exhibit more fully. Colour is generally looked upon as a high red colour or flush, whereas well-coloured yellow apples, more particularly if a flush is present, such as is found in Cleopatra, Dunn's Favourite, &c., gives such apples a good appearance. "Appearance" may also be used to cover other characteristics of an exhibit.

Colour with respect to cooking-apples is always a controversial question; but when it is considered that attractiveness is of importance in connection with fruit shows generally (which aim at the spectacular), colour—even if it is not necessary in connection with cooking-apples—is worth something from a show point of view. However, in consideration of its more or less minor importance in connection with the cooking-apple, the points have been kept well down as compared with condition and cooking-quality. This has been done in order that highly coloured apples more or less out of condition would not be in a position to score a win over apples excelling in condition and cooking-quality, unless the latter were considerably weaker in other essentials.

Staging.—Points for staging have been deleted. All fruit should be staged on bare plates where plates apply. Any ornamentation of the stand should be attended to by the show officials.

Case Exhibits.—All cases are to bear a standard export label on either end, but such labels should in no way indicate the name of the exhibitor.

Exhibition and Commercial Types.—While not recommending that a hard-and-fast rule be made, it is suggested that plate and collection competitions be mainly restricted to apples of exhibition type, and case competitions to apples of commercial type.

PASTURE TOP-DRESSING IN CANTERBURY.

(Continued.)

F. E. WARD, H.D.A., Instructor in Agriculture, and A. W. HUDSON, B.Agr., B.Sc., Assistant Instructor in Agriculture, Christchurch.

EXPERIMENT ON FARM OF H. E. PERYMAN, TAI TAPU.

IN continuation of the endeavour to determine the relative values of the manures used in the experiments the results of which were published in last month's issue of the *Journal* (page 393), another trial was conducted at Tai Tapu, on the farm of Mr. H. E. Peryman. The manures and quantities applied were the same as those of the 1924 dressing on W. G. Macartney's paddock,* and were arranged in exactly the same order (see June *Journal*); but in this case, owing to a very long area being used, the manured plots were duplicated only. Application of the fertilizers took place on 19th August, 1924, and the field was closed for the hay crop about a month later. The main constituents of the pasture were red clover and perennial rye-grass, with suckling-clover, black medick, yarrow, and Poa pratensis in small quantity in places. Hawkweed and catsear were also present.

OBSERVATIONS DURING GROWTH OF PASTURE.

On 23rd October the area was visited by the writers, and the manured plots were easily distinguished by their superior growth of red clover. At time of cutting the first crop, on 10th December, the clover-growth was very prolific and the manured plots were undoubtedly better than the controls. The difference is shown in the accompanying photograph, where a distinct line of demarcation between a control and a manured plot can be easily distinguished.

On 13th February, 1925, the paddock was visited again, and was found well covered with a splendid growth of clover kept for seed. The controls were still easily distinguishable by the fact that the clover on them was shorter and much paler in colour than on the treated plots. The opportunity of following up the effect of fertilizers seemed too good to lose, and Messrs. Peryman Bros. very kindly consented to cut strips for weighing. In order to reduce the area cut to a minimum, fewer weighings were made than on the first cut—just sufficient being taken to ensure a "probable error" of satisfactorily small dimensions.

Measuring, cutting, and weighing of the crop were carried out in the same manner as adopted with Macartney's, except that a cut was taken down the middle of each strip and through the standing crop, as shown in photo (Fig. 2) in June article. The dimensions of each weighed plot were one width of the mower-cut (5 ft.) by ½ chain, giving an area of $\frac{1}{264}$ acre. Thirty weighings were made in each treatment in the

*(1) Superphosphate (42–44), 2 cwt.; (2) superphosphate (42–44), 2 cwt., plus dried blood, ½ cwt.; (3) basic super (40–43), 2 cwt.; (4) basic super (40–43), 2 cwt., plus dried blood, ½ cwt.

first crop, and twenty-four in the second. The results of weighings of both crops are given in Table 6, and the evaluation of the total increases in Table 7.

Owing to the fact that a greater loss of moisture was expected from the material on the manured plots, due to their greater clover content, separate lots of samples were taken from manured and control areas. The differences which actually occurred were of about the same order as the probable errors, and must therefore be considered negligible. The percentage hay-weight was determined in the manner described in the previous article, and was found to be not less than 28·5 in the first crop and 29·2 in the second (odds of 30 : 1).

Table 6.—Showing Yields of various Manurial Treatments compared with Controls and with one another in the two Hay Crops.

Treatment.	First Crop.				Second Crop.			
	Number of Plots compared.	Tons of Hay per Acre.		Yields expressed as Percentage Controls = 100.	Number of Plots compared.	Tons of Hay per Acre.		Yields expressed as Percentage Controls = 100.
		Yield.	Difference.			Yield.	Difference.	
Super	30	2·70	0·86	147	24	2·13	0·39	123
Control	30	1·84	..	100	24	1·73	..	100
Basic super ..	30	2·60	0·76	142	24	2·28	0·55	132
Super and blood ..	30	2·76	0·74	136	24	2·14	0·38	121
Control	30	2·02	..	100	24	1·76	..	100
Basic super and blood	30	2·55	0·53	126	24	2·18	0·42	124
Super	30	2·70	Difference not significant		24	2·13	Difference not significant.	
Basic super ..	30	2·60			24	2·28		
Basic super ..	30	2·60	Difference not significant		24	2·28	Difference not significant.	
Basic super and blood	30	2·55			24	2·18		
Super and blood ..	30	2·76	0·21	..	24	2·14	Difference not significant.	
Basic super and blood	30	2·55	..	..	24	2·18		

Table 7.—Valuation of Total Increase in Yield of both Crops due to Manure.

Treatment.	Increase over Control in Tons of Hay per Acre (Sum of Increases in First and Second Crops).	Value of Increases at £5 per Ton.	Cost of Manure per Acre at Country Stations.	Net Profit per Acre resulting from Use of Manure.	Percentage Increase above Control.
		£ s. d.	£ s. d.	£ s. d.	
Super	1·25	6 5 0	0 14 6	5 10 6	35
Basic super	1·31	6 11 0	0 13 6	5 17 6	37
Super and blood ..	1·12	5 12 0	1 1 0	4 11 0	29
Basic super and blood ..	0·95	4 15 0	1 0 0	3 15 0	25

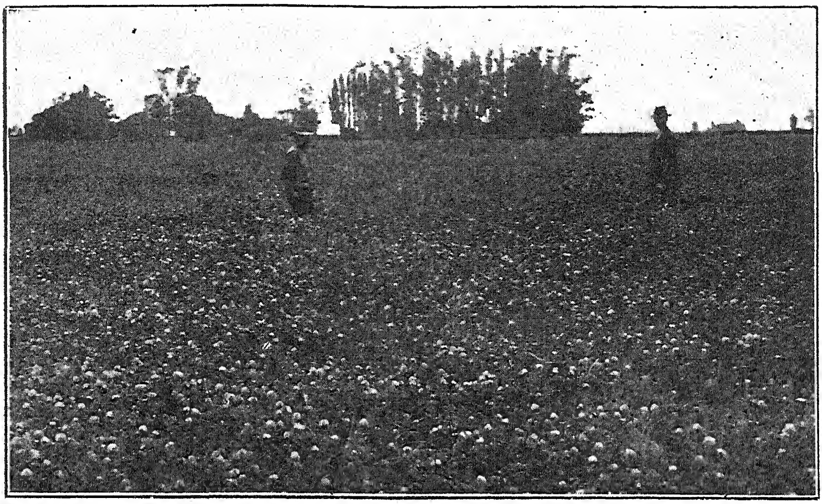


FIG. 3. SHOWING PORTION OF TOP-DRESSED AREA ON MR. PERYMAN'S FARM, AS OBSERVED 10/12/24.

Left—super; middle (between men)—control; right—basic super. Line of demarcation may be distinguished running away from observer through position occupied by man on left.

CONCLUSIONS.

All increases over controls are highly significant, but when the manures are compared with one another the differences are not measurable with certainty, excepting in the case of super and blood *versus* basic super and blood in the first crop.

The addition of blood to the phosphates has not produced an increase in yield, and, as seen in Table 7, the phosphates alone show a greater net profit than the mixtures.

To Messrs. Peryman Bros. we are greatly indebted for their valuable aid and interest, which enabled the experiment to be carried out so successfully.

NOTE.—In the June issue, at the top of page 398, an apparent inconsistency in the use of odds will be noticed. Owing to an error in the application of the statistical method, the factor 2·7 (giving odds of 13 : 1) was used instead of 3·2 (giving odds of 30 : 1) in estimating that percentage hay-weight regarded as a certainty. As all quantities had been worked out using factor 2·7, and the article had gone to press before the error was noticed, the slight alteration in the acceptance of odds for certainty was the easiest way out of the difficulty. If we take the "certainty percentage" as 36·8 (·73 × 3·2) = 34·46—say, 34·4 per cent.—the amount to be corrected will be about 0·01 tons in the "Difference" column of the tables. This will necessitate a reduction of about 1s. in each of the two columns headed "Value of Difference at £5 per Ton" and "Net Profit per Acre." It will be seen that the result is not materially affected.

Young pastures should not be fed off too closely, especially with sheep. The young roots need shelter from frosts during winter.

ELECTRIC POWER TRANSMISSION POLES.

SUPPLEMENTARY NOTES ON EUCALYPTS.

J. H. Simmonds, Takanini, Auckland.

The case for the eucalypts grows constantly stronger with increasing information. Since the article published in the March *Journal* was written the writer has had opportunity to extend his researches in both Islands. Valuable plantations have been found in localities not previously visited. Vigorous single specimens and groups numbering up to thousands thus located and inspected show that not a word too much has been said about some of the species already recommended as pole-yielders, while much may be said in favour of other species.

NORTH ISLAND.

The first agreeable surprise was met at "Puketiti," near Tokomaru Bay (A. B. Williams). The homestead and plantations here are in latitude 38, at an altitude of 1,000 ft. to 1,100 ft. above sea-level, and about five miles from the coast. The rainfall is generous, the winter temperature cool and exhilarating, but never severely cold. Less than half a lifetime ago these plateaux and slopes carried only grass and low herbage; now they are adorned with shrubs and trees the larger of which will soon reach 100 ft. in height. Adequate description would run far beyond the limits permitted for these notes. We are concerned just now with eucalypts, and especially with trees that will serve well as electric-wire carriers. *Eucalyptus obliqua*, *E. regnans*, and *E. fastigata* have all found a congenial home at "Puketiti"; but these are trees that yield their best value when sawn up into boards and scantling. *E. botryoides*, *E. saligna*, *E. pilularis*, and *E. eugenioides* are here in small numbers, and could quite certainly be multiplied indefinitely. They are all pole-yielders. *E. amygdalina* and *E. Risdoni* are here in vigorous but not well-formed specimens. *E. ovata* (syn. *E. acervula*) is represented by a stand in which many of the poles are already large enough for use. Last, but in some respects first in importance, is a group of *E. cladocalyx* (syn. *E. corynocalyx*). These are not yet mature enough for cutting, but they are tall and straight, and in a good growing-condition. The example suggests further experiment with this especially valuable pole-tree. Climate and soil here offer great advantages for timber-production.

Fifty miles south of Tokomaru Bay one finds the eucalypts again well represented. Several farms possess smaller or larger numbers of them. On the "Sherwood" estate (Williams Bros.) twenty or more valuable species could be counted. For rapidity of growth and good pole-form *E. botryoides* at present carries the honours. In a belt planted on rich alluvial land one tree has a total height of 95 ft., a usable bole of 50 ft., and a breast-high diameter of 23 in. Other specimens in the same belt are nearly as large. The age of these trees is reported to be under twenty years. The situation is near the coast and not very high above sea-level. Mr. C. H. Williams, one of the brothers, whose private address is "Coventry," Gisborne, takes an enthusiastic interest in tree-culture. Acting upon his suggestion the local County Council is making fencing-post tests with all available exotics, whether eucalypts or durable conifers.

The writer has frequently visited the Wairarapa district and reported upon the cultivation of eucalypts there (*Journal*, June, 1918). During a recent visit he had the pleasure to find young saplings of *E. Bosistoana* flourishing in two localities. These plants represent a very valuable pole-species, and their behaviour under the test of coming seasons will be competently watched and recorded by Mr. H. G. Groves, of "Marangai," to whom we are indebted for raising and distributing the seedlings. Only by such experiments can we hope to adequately advance and enrich our forestry.

At "Tunanui," Hawke's Bay (Sir Andrew Russell), there were a few years ago some eucalypts that, if still standing and flourishing, well merit mention in these supplementary notes. The species represented were the Tasmanian "peppermints," *E. amygdalina* and *E. Risdoni*, both of which are reputed to yield timber exceedingly durable in contact with the ground. The specimens at "Tunanui" were good enough to be recommended as sources of seed for future plantings.

SOUTH ISLAND.

Passing to the South Island, it has not been practicable just recently for the writer to visit Nelson and Marlborough, but in Canterbury and Otago extended journeys have yielded new information of great value. It is too often assumed that the climate throughout these two provinces is very cold during periods of the year. This is far from the truth. Parts of Banks Peninsula and the coastal districts north of Christchurch are relatively very mild. Limited areas in Otago, again, are milder than middle Canterbury. Only by remembering these differences will the useful range of certain eucalypts in these provinces be understood.

On Banks Peninsula, at Charteris Bay, Mr. Orton Bradley has for many years been planting conifers, eucalypts, wattles, and various other trees and shrubs. The mildness of the climate is well evidenced by the eucalypts, for among them we find such species as *E. paniculata*, *E. ficifolia*, and *E. calophylla* variety *rosea*. These, it is true, are only just holding their own in specially favoured situations; but *E. botryoides*, *E. saligna*, and even *E. cladocalyx* are doing well and promising to yield good wire-carrying poles. This report is the result of a quite recent inspection of the trees, and may be taken as very encouraging.

Eastward from Charteris Bay one comes to Little River. Here, at "Okuti" (Dudley Richards), was discovered the best stand of *E. eugenioides* yet seen by the writer in New Zealand. The plantation was started about thirty-one years ago by sowing the seed in small spots prepared by grubbing. There were some losses in the following winter from severe weather, but on the whole the resultant crop was good and fairly regular. The spacing was sufficiently close to suppress side branches except on the margins of the plantation. The trees cover several acres. Seen in perspective their tall boles clothed with furrowed fibrous bark make a very impressive picture. A hasty estimate placed the number of trees at between three thousand and four thousand. A specimen felled by Mr. W. T. Morrison, of the Forest Service, for the Exhibition at Dunedin, showed a large percentage of mature wood. The species has a high reputation for durability of its wood in the ground. For thorough ripening these poles should stand another four or five years, and then they should be easily worth

£1 each on the stump. Seed blown from the plantation into an adjoining grass-paddock has freely germinated and given birth to a chain-wide belt of vigorous seedlings. Through an unfortunate error on the part of a seedsman thirty-one years ago an adjacent area of some acres was sown with *E. haemastoma*. This is a species of very low merit, and the resultant loss to the owner of the land will probably not be less than £1,000. The seed was supplied under the name of "yellow-box," which is the common name for a quite different tree. Primary responsibility for the error no doubt rested upon a seed-collector who was either ignorant or dishonest. The lesson for future planters is obvious.

In the Waipara-Parnassus region the most impressive example of exotic-tree planting is seen at "Cheviot Hills," the residence of Lady Campbell. Adequate description would require several pages, and with Lady Campbell's permission this may be undertaken at some future time. Our present concern is to find poles that will carry electric wires and will be long-lasting. In these plantations the most promising tree for such purpose is the Tasmanian "peppermint," *E. amygdalina*. The rather numerous specimens are growing among other trees and have been drawn up to a good pole-height with straight, clean poles. These plantations are of considerable age, and the "peppermint" trees have probably been mature enough for use for the last twenty years. It is reported that specimens felled even earlier than that yielded very lasting fence-posts.

At "Happy Valley," Motunau (L. H. Campbell), there are wide belts of eucalypts, the total length of which is considerably over a mile. The constituent species are *E. globulus*, *E. obliqua*, and *E. amygdalina*; and here again the "peppermint" is giving a good account of itself as a pole-tree. The numerous specimens have well maintained their place and their right to head-room among the other trees. Some of the poles are large enough for use. The date of planting was not ascertained.

These good examples seem to warrant the inclusion of *E. amygdalina* among the pole-yielders; but we have not yet reached a satisfactory position with respect to choice of strain and collection of seed. The botanical name is now restricted to trees indigenous to Tasmania; but the trees included constitute a group or series rather than a narrowly defined species. Some of the trees have very narrow leaves and small seed-cups, and shed their dead bark right down to the ground. They are often of small dimensions. These trees are called by woodmen "white peppermint," and (in their extreme form) by botanists *E. linearis*. Other trees have wider leaves and larger seed-cups, and carry a dead sub-fibrous bark on the lower part of their stems. The trees are often of good milling dimensions. These are called by the woodmen "black peppermint," and by the botanists *E. amygdalina*. Between these extremes there are many intermediate forms, and no one has yet been able to draw a sharp line between *E. amygdalina* and *E. linearis*. It is said that mature wood from any of these Tasmanian "peppermints" will be long-lasting; but the high reputation of the group as a whole has been won mainly by the "black peppermint." In selecting a tree for cultivation bulk as well as durability has to be considered. The only safe course for the future in this case will be to obtain seed either from certified and approved trees in Tasmania

or from the best and largest of our own acclimatized specimens. Subject to this being done, *E. amygdalina* may be included in our pole list. All these Tasmanian "peppermints" appear to be capable of growing on drier country than is suitable for most of the eucalypts.

The case for *E. Risdoni* is similar to that of *E. amygdalina*. In Tasmania the name stands for a group or series rather than for a distinctly and sharply defined species. Some forms remain small to maturity; others grow to a height of 60 ft. or 80 ft., with a corresponding diameter. In the cooler middle regions of New Zealand we have many excellent specimens; but we have also many feeble or spreading specimens of low value. We appear to have propagated from good and inferior strains without discrimination. *E. Risdoni* timber has a favourable reputation for lasting in the ground, and if in future we resolutely restrict our propagation to seed collected from vigorous trees of large dimensions the species may also be included in the list of pole-yielders. Mr. R. G. Robinson, Superintendent to the Selwyn Plantation Board, finds that *E. Risdoni* maintains a good standard of vigour on parts of the Canterbury Plains that are a little too dry for *E. viminalis*. Apparently both *E. amygdalina* and *E. Risdoni* can claim a high degree of resistance to dry conditions, and if further experience confirms their claim they will be very welcome in situations where ground moisture and rainfall are insufficient for most other timber-yielding species. Tall *E. Risdoni* and smooth-barked *E. amygdalina* may both be seen growing on a rather dry hillside at Whakarewarewa (Rotorua).

A fresh study of *E. Gunnii* as growing in Otago and Southland tends to dismiss all doubts as to the value of that tree for pole-production in those provinces. Splendid specimens noted some years ago in the Drummond district, Southland, have already been described in the *Journal* (April, 1916). Similar specimens recently inspected in the Cemetery Reserve, Tapanui, and in a plantation near Heriot, can now be reported. Many other specimens of smaller dimensions but equally vigorous could be mentioned. The tree is exceedingly resistant to cold, stands up well against strong winds, grows rapidly, and under forest conditions develops a tall clean bole. The heartwood is reported to be dense and very hard. Records of tests for durability are not yet available, but the writer would have no hesitation in anticipating a life of twenty years for quite mature poles not less than 1 ft. 3 in. in diameter at the base. Competent tests should be made without delay.

In the course of this research several species of eucalypts that were supposed to be climatically barred from descending farther south than about latitude 43 have been found in a flourishing condition in warmer parts of Otago. There appears to be in progress an acclimatizing process, which, aided by persistently careful selection of parent trees, may be expected to ultimately extend the range of many valuable species.

The Deer and Wild-pig Nuisances.—By means of an open shooting season in certain districts and bounty payments made through the State Forest Service a total of 7,433 deer was accounted for during the official year 1924–25. In the same period over 9,000 wild pigs were destroyed under a system of small bounties.

STINKING-SMUT OF WHEAT.

III. FIELD GERMINATION OF SEED TREATED WITH FORMALIN AND CLARKE'S WHEAT PROTECTOR.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

IT was noted in Article II of the present series (*Journal*, May, 1925) that the field germination of wheat treated with formalin and with Clarke's Wheat Protector presented features which required further investigation. The results are here recorded of a series of field sowings of wheat which had been treated with these two disinfectants, and in which the conditions of treatment followed more closely the usual procedure in farming practice. The chief difference consisted in allowing the treated seed to dry out slowly in bulk, instead of the rapid artificial drying of small lots practised in the former experiments.

EXPERIMENTAL METHOD.

Formalin: Seed dipped in bulk for ten minutes in a solution of 1 pint of commercial formalin (39 per cent. formaldehyde) to 40 gallons water, then left in bag to drain and gradually dry out.

Clarke's Wheat Protector: Seed thoroughly wetted with solution made up by adding contents of packet (1 lb.) to 1½ gallons water, then left in bag to gradually dry out.

Two samples of Solid-straw Tuscan wheat were used, one Canterbury-grown and harvested in 1924 (from the same line used in the experiments recorded in the May *Journal*), and the other grown at Weraroa and harvested in February, 1925. Date of treatment, 22nd April, 1925. Sowings were made at the Central Development Farm, Weraroa, five hours, twenty-nine hours, forty-eight hours, seven days, and twenty-one days after treatment, the seeds being sown by hand 2 in. apart, 100 seeds to the row. Germinations were counted when the plants were 4 in. to 6 in. high.

SUMMARY OF EXPERIMENTAL RESULTS SHOWN IN TABLE.

Formalin: On the new seed the treatment did little damage, even after holding for three weeks, while on the one-year-old seed there was an immediate loss of germination of 5 per cent., which increased steadily up to 26 per cent. after holding for three weeks.

Clarke's Wheat Protector: This treatment gave an increased germination over the untreated seed both on the new and one-year-old seed, though the effect was more marked on the latter. No significant difference was shown by the sowings made at the various intervals up to three weeks after treatment.

Table showing Field Germination of Wheat treated with Formalin and Clarke's Wheat Protector.

Treatment.	5 Hours.		29 Hours.		48 Hours.		7 Days.		21 Days.		Difference from Mean Control.				
	Counts.	Mean.	Counts.	Mean.	Counts.	Mean.	Counts.	Mean.	Counts.	Mean.	5 Hours.	29 Hours.	48 Hours.	7 Days.	21 Days.
1924 Tuscan.															
Untreated	86, 86	86·0	79, 90	84·5	81, 81	81·0	81, 83	82·0	75, 75	75·0	..	..	..	..	..
Formalin	84, 77, 80, 77	79·5	77, 74, 75, 82	77·0	76, 70, 70, 69	71·2	65, 65, 66, 67	65·7	50, 53, 43, 48	48·5	−5·2	−6·8	−11·6	−13·6	−26·6
Untreated	85, 84	84·5	82, 89	85·5	85, 85	85·0	82, 77	79·5	72, 73	72·5	..	..	..	..	..
Clarke's Protector	88, 94, 91, 93	91·5	94, 89, 88, 88	89·7	91, 92, 91, 89	90·7	88, 90, 86, 92	89·0	82, 78, 83, 78	80·2	+6·8	+5·9	+7·9	+9·7	+5·1
Untreated	83, 84	83·5	81, 82	81·5	78, 87	82·5	80, 73	76·5	81, 75	78·0	..	..	..	..	..
1925 Tuscan.															
Untreated	88, 83	85·5	77, 72	74·5	76, 78	77·0	78, 88	83·0	73, 79	76·0	..	..	..	..	..
Formalin	81, 86, 78, 80	81·2	70, 73, 76, 80	74·7	72, 69, 77, 77	73·7	82, 80, 75, 80	70·2	77, 69, 78, 66	72·5	+1·2	−2·3	−5·5	−0·6	−2·5
Untreated	72, 73	72·5	76, 79	77·5	78, 84	81·0	78, 80	79·0	76, 72	74·0	..	..	..	..	..
Clarke's Protector	82, 83, 82, 84	82·7	83, 85, 82, 78	82·0	77, 86, 85, 83	82·7	82, 80, 83, 87	83·0	84, 76, 75, 78	78·2	+2·7	+5·0	+3·5	+3·2	+3·2
Untreated	85, 79	82·0	80, 78	79·0	83, 76	79·5	77, 78	77·5	76, 74	75·0	..	..	..	..	..

THE WAX-MOTH AND ITS CONTROL.

E. A. EARP, Senior Apiary Instructor, Wellington.

OF the two bee or wax moths—*Galleria mellonella* and *Achrœa grissella*—troublesome to beekeepers in New Zealand the larger one (*G. mellonella*) is the more destructive. This moth was first observed by apiarists in Taranaki in 1904, and it is probable that it came from Australia with importations of bees and queens. It is included among the diseases of bees that come within the provisions of our Apiaries Act, and beekeepers who fail to notify its presence are liable to prosecution.

Observations made show that the moth is spreading, it having been reported recently in districts where it was previously unknown. It is widely distributed in the North Island. For years it has been a serious pest to beekeepers in the Nelson District, where it was observed by the writer in 1909, and during the past three years it has made its appearance in Marlborough. The moth is fairly common in hives as far south as Westport. The transport of section honey and bees from the Nelson District may account for its spread to Marlborough and the west-coast areas.

Beekeepers of those districts who have had considerable experience with the larger moth are finding it more difficult to control than foul-brood, mainly owing to the presence of large numbers of colonies of black bees and to climatic conditions which are in favour of the development of the pest. Where proper methods of control are lacking, through the beekeeper failing to recognize the insects, he will find that they take steady toll of his valuable combs, and at the same time totally destroy weak or queenless colonies. The warmer conditions of parts of the North Island during the winter months extend the breeding season of the moths. As no dormant period appears to exist the larvæ are a constant menace, especially as they are active when combs are not in use and the bees are least aggressive. Possibly the fact that the moths are seldom to be seen except at dark, unless disturbed in their hiding-places, may account to some extent for this pest of the apiary not being more commonly known.

The moth lays its eggs on the combs, sides, and bottom of the frames and in crevices of the hives, where the larvæ can find their way to the combs. The larvæ of the moths have a preference for brood combs, burrowing through them under the cover of strong silken galleries, which they spin as a means of protection from the bees as they advance in their work of destruction. When fully grown the larvæ are from ⅞ in. to 1 in. in length, and may be detected by holding the comb up to the light. Where the combs in the hives are left undisturbed the beekeeper will often find the cappings of the sealed brood removed and the webs of the larvæ showing as he withdraws the frames. A favourite haunt of the larvæ is on the top of the frames under the mat, or where there are two mats they will get between them. In the daytime they apparently hide, and at night attack the combs, but when the colony becomes weak the larvæ exhibit less fear and attack the combs at all times.

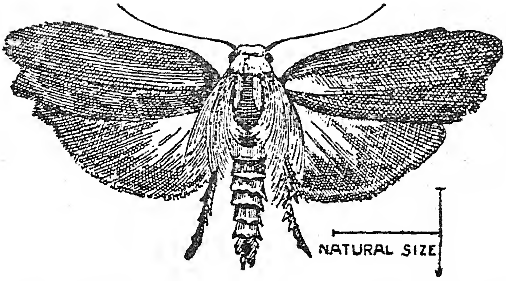


FIG. 1. LARGER WAX-MOTH (GALLERIA MELLONELLA).

FIG. 2. COMB ATTACKED AND NEARLY DESTROYED BY LARGER WAX-MOTH.

CONTROL MEASURES.

In order to guard against the ravages of the moth all weak hives should be strengthened. Black bees are especially liable to attack, and in those districts where the pest is known to exist no better plan can be followed than to replace old and failing queens with vigorous Italians. The latter are better able to withstand the pest, and if the colonies are kept normal the bees will be able to defend themselves. All odd pieces of comb should be melted or otherwise disposed of, and as the mats afford a particularly good breeding-place these should be destroyed by fire whenever they are judged to be infected. In the case of supers or hive-bodies which have contained moth-infected combs, a careful scorching of the inside corners and crevices should be made with a painter's blow-lamp in order to destroy any eggs or larvæ that may be present.

All combs should be examined periodically, and if traces of the moth are found they will require to be fumigated. In bad cases the operation must be repeated, allowing an interval of thirty days. If only a few combs are to be fumigated they may be suspended about 1 in. apart in empty hives, and the latter piled one on the other, taking care that the junctions of the bodies are made smoke-tight by pasting strips of paper round them. The topmost box should contain no frames. In this box place an old iron saucepan containing live wood-embers, and on to these throw a couple of handfuls of sulphur. Close the cover securely and keep closed for a couple of days.

Bisulphide of carbon may also be used as a fumigating agent. When using this chemical the combs may be put in a tight box, or placed in hives as described, and the same care taken to close all cracks to prevent the fumes from escaping. A quantity of the bisulphide is placed in an open dish on top of the combs. The liquid evaporates, and the fumes, being heavier than air, settle over the combs, thus effectively killing all insect-life present. In case all the eggs are not destroyed the operation may have to be repeated. Great care must be exercised when using this chemical, as it is highly explosive and dangerous. On no account should a fire or light be allowed near the liquid when it is being used.

When a beekeeper is operating in a commercial way, and large numbers of combs have to be dealt with, it is advisable to have a room fitted up for the purpose of fumigation. The combs can either be placed on racks or left in the hive-bodies. If the latter course is followed the hive-bodies require to be spaced so as to allow the fumes to enter freely. If sulphur is used in the process of fumigation, then 2 lb. or 3 lb. may be necessary to effectively destroy the larvæ. Should the eggs of the moth not be destroyed the operation will require to be repeated.

Pasture Top-dressing and Stock.—In the course of an article on the Weraroa Red Poll herd, contributed to the *Journal of Agriculture* of Victoria, by Colonel A. Caddy, he remarks: "The first thing that strikes the visitor to Weraroa (Central Development Farm) is the good pasture, and as a result a general sleek look of healthy contentment is present in all the live-stock. Top-dressing with phosphate of lime is answerable for this, and, as elsewhere, that fertilizer causes the Red Polls to spend most of their time resting and chewing the cud, instead of wandering about restlessly looking for vitaminiferous feed."

USE OF THE BAUMÉ HYDROMETER IN WINE AND CIDER MAKING.

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

HYDROMETERS, of which there are several types, are instruments which sink in liquids until they displace a volume equal to themselves in weight. In a dense liquid, therefore, they will not sink so deeply as in a less dense one. The Baumé hydrometer is weighted with shot or quicksilver so that it sinks in pure distilled water to the zero degree on the scale marked on its spindle. The degrees on the spindle indicate the amount of solids (which for practical purposes can be calculated as all sugar) contained in the juice.

This hydrometer is used in several trades, and, although an arbitrary scale so far as wine is concerned, it is very popular among winemakers. This is owing to the fact that by a curious coincidence degrees Baumé (within the range usually employed by winemakers) recorded in an unfermented must or fruit-juice approximately indicate the degree or percentage of absolute alcohol the wine will contain after complete fermentation. Thus a must registering from 10° to 11° Baumé will produce a wine containing from 10 to 11 per cent. of absolute alcohol — that is, 10 to 11 measures or volumes of pure alcohol in 100 measures of wine when all the sugar has been transformed, which is not always the case, especially if the alcoholic strength goes beyond 14 per cent. Above and below these degrees (10 to 11 per cent.) the quantity of alcohol does not correspond so nearly, but the indications are near enough for general purposes.

The ratio of alcohol produced to density is not the same in apple-juice as in grape-juice. To estimate the approximate amount of alcohol which apple-juice will produce on complete fermentation, 1° should be deducted from the degree Baumé recorded in the fresh juice. Apple-juice registering 8° Baumé, and subsequently fermented dry, will be found on analysis to contain approximately 7 per cent. of alcohol by volume.

The juice should be freshly expressed from the fruit, tested in a glass jar or cylinder before any fermentation sets in, and the degree Baumé read in a line with the main surface of the liquid—not at the point where it has mounted up the spindle by capillarity. The scale of this hydrometer being graduated at a temperature of 60° F., it is essential to bring the temperature of the liquid being tested as near as possible to that degree. If the temperature is slightly above 60°, add one-fifteenth of a degree Baumé for each degree Fahrenheit; or if below, subtract one-fifteenth.

In order to ascertain if a fruit has attained the maximum of saccharine contents, an average sample should be taken from time to time during the ripening-period, crushed, and strained into a test jar; when no further increase is indicated by the Baumé scale the fruit may be considered ready for making wine.

If the degree Baumé of the must is not high enough to produce the alcohol desired in the finished wine, then for each additional degree or per cent. of alcohol required add 4 oz. of No. 1 cane-sugar to each gallon of must, bearing in mind that to obtain a dry wine it

is not advisable to raise the saccharine contents of the must above 14° Baumé. The sugar should be added before fermentation sets in and thoroughly dissolved in the must, as otherwise it will form a hard cake on the bottom of the barrel or vat.

Must below 14° Baumé will ferment out dry under favourable conditions, but above 14° the complete fermentation is not to be depended on. The progress of fermentation can be followed by observing the gradual sinking of the hydrometer in the liquid. In wine which has fermented out nearly dry—that is, in which most of the sugar has been transformed into alcohol and carbon dioxide—the Baumé will sink to about zero, the exact point depending principally on the amount of alcohol present, alcohol being lighter than water. At this stage the wine, including that pressed from the skins, is usually transferred from the fermentation-vat to a maturing vat or cask to continue there a slow fermentation, during which the remaining sugar is transformed into alcohol and carbon dioxide, or, in the case of sweet wine, sufficient alcohol is formed to prevent the ferments continuing their work.

In making sweet wines on a commercial scale sufficient alcohol is added to the wine, when the saccharine contents have fermented out to 2° or 4° Baumé, to bring up the alcoholic contents to 16 per cent. This addition prevents further fermentation, and the remaining 2° to 4° Baumé, which represents 3½ to 7 per cent. of sugar, gives the desired sweetness. In making small quantities of sweet wine, and when no alcohol is added, sufficient sugar should be dissolved in the wine to bring it up to 18° or 20° Baumé before it is run into the maturing-cask, which must not be bunged tightly until all fermentation has ceased.

The Baumé hydrometer, graduated 1° to 25° for liquids heavier than water, and glass jars for use with same, are obtainable for a few shillings from wholesale chemists or scientific-instrument dealers.

INTERIM RETURN OF SHEEP, 1925.

The following particulars, showing the approximate number of sheep in New Zealand at 30th April, 1925, compared with the final figures for 1924, were gazetted on 25th June:—

District.	Number of Sheep.		Difference.
	Final Return, 1924.	Interim Return, 1925.	
Auckland	1,968,115	1,995,270	+27,155
Gisborne - Hawke's Bay	6,277,917	6,178,116	−99,801
Wellington-West Coast	5,232,685	5,081,071	−151,614
North Island totals	13,478,717	13,254,457	−224,260
Marlborough-Nelson-Westland	1,272,533	1,330,064	+57,531
Canterbury-Kaikoura	4,711,095	4,934,981	+223,886
Otago	4,313,431	4,483,240	+169,809
South Island totals	10,297,059	10,748,285	+451,226
Dominion totals	23,775,776	24,002,742	+226,966

EFFECT OF PROJECTING STAPLES ON BUTTER PACKED IN "FOUR-ONE" BOXES.

AN investigation has recently been carried out by the State Forest Service (Forest Products Branch), in co-operation with the Dominion Laboratory, into the effect of projecting staple heads or points upon butter packed in "four-one" and similar wire-bound boxes. The following report by Mr. W. Donovan, Assistant Dominion Analyst, issued by the Forest Service, presents the information acquired. It will be noted that standard export packing with two thicknesses of paraffin paper is considered effective protection against rusting of staple heads and points.

The construction of four-one and similar boxes, such as the Saranac package recently adopted by the New Zealand Co-operative Dairy Company, entails the use of staples upon the inner surface of the ends. The points of the staples securing the outer wires of the boxes also pierce the sides, top, and bottom, being clinched over upon the inner surfaces. Occasionally, however, the clinching is missed, and the sharp points then project into the box. It was desired to ascertain if such projecting points would injuriously affect the quality of butter packed in the boxes.

Method of Test.—Small wooden boxes were obtained, and wire staples driven into the sides so that the points projected inside about $\frac{1}{4}$ in. Half the staples were made from black iron wire, and half from galvanized iron. In some boxes the points were left projecting, in others they were clinched. In filling with butter, some were not lined, some were lined with a single layer of paper, and the remainder with a double layer, as for export. The boxes were filled on 4th November, 1924, and placed in cool store until 25th May, 1925, a period of six months and a half, when they were examined.

Results.—In the first series, where no protective paper was used, the iron-wire staples were badly rusted, and had discoloured the butter for a distance of $\frac{1}{4}$ in. round each point. The zinc coating of the galvanized-iron wire staples had also been attacked, but the iron was apparently not affected. There was no discoloration of the butter round these staples, and no marked taste has been imparted to it. Chemical examination showed that it contained only a trace of zinc.

In the second series, in which the boxes were lined with a single layer of paper, only one in three of the unclinched staples had come in direct contact with the butter, such staples being rusted if iron, or somewhat corroded if galvanized, as in the previous series. None of the clinched staples had come in contact with the butter, and there was very little discoloration of the paper.

In the third series, lining the boxes with a double layer of paper, as for export, had reduced still further the proportion of projecting points that had come in contact with the butter, and had afforded effective protection from all contact with clinched staples.

Conclusions.—The proportion of staples missed in clinching in the boxes under consideration is very small, and probably less than one-third of these will pierce a double layer of lining-paper. While the galvanized coating remains, the iron will not be sufficiently attacked to cause discoloration, and in any case only a very small area of butter will be affected. This can be readily removed.

The boxes can therefore be safely used for the export of butter if lined with paper in the usual way, and there is no need to coat the staples with a protective covering of paraffin-wax or shellac.

Average Grades of Dairy Factories, 1924–25.—In the list published in last month's *Journal* the average grade of the Rongotea Company, given as 92·14 points, should have been 93·08. Similarly, the average of the Rata Company

TESTING OF PUREBRED DAIRY COWS.

APRIL TO JUNE C.O.R. LIST.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE appended list gives particulars of performance of all cows which received certificates of record during months of April, May, and June—a comparatively quiet period of the year in the working of the system.

The highest butterfat-yield, and in many respects the most worthy performance, is that of Messrs. Ranstead Bros.' Milking Shorthorn cow Matangi Quality 4th, which is credited with 22,010·5lb. milk and 978·47 lb. butterfat in 365 days. Her age at commencement of the test was 4 years 190 days, and it is unfortunate that she should have calved some eleven days too late to qualify for a first-class certificate. According to our records she should, on a normal gestation, have calved within the period allowed by the rules. This was Matangi Quality 4th's third consecutive season on C.O.R. test, and on each of her previous performances she gained a first-class C.O.R. which placed her at the head of her class for the breed. She was calved on 15th August, 1919, and began her first test on 1st December, 1921, which resulted in a production of 591·89 lb. butterfat, her age at start being 2 years 109 days. On 15th January, 1923, at the age of 3 years 153 days, she was commenced on her second test, and gained a first-class certificate for 678·02 lb. butterfat. It is with regret that we record the death, through calving complications, of Matangi Quality 4th, for undoubtedly she was one of the most outstanding cows of the Milking Shorthorn breed in New Zealand.

Another record of interest appearing in this list is that of Messrs. North and Sons' wonderful old cow Burkeyje Sylvia Posch. She already had six first-class certificates of record to her credit, and missed the seventh by only ten days. Commencing at 11 years 215 days, she has given a yield of 864·38 lb. butterfat in 365 days. So far as we are able to ascertain, Burkeyje Sylvia Posch holds the world's record in any breed for "long-distance" authenticated performance.

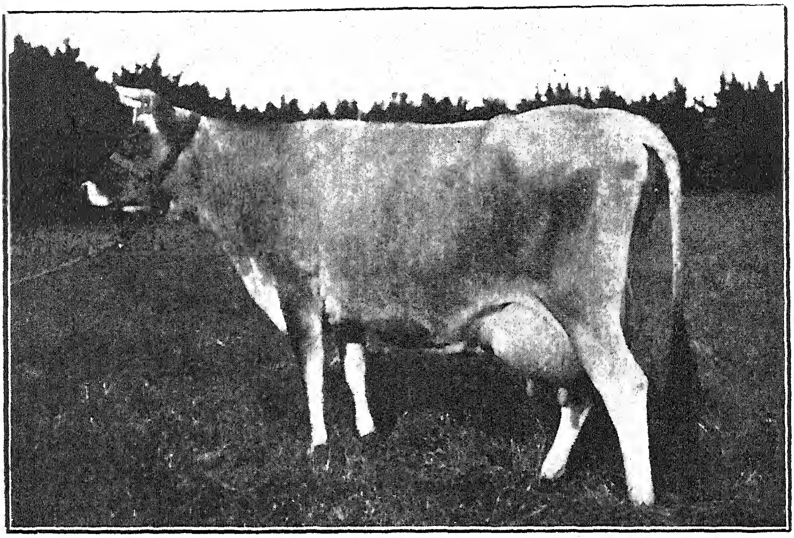
LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Pukatea Zona ..	G. R. Bell, Waipuku ..	1 363	240·5	365	7,612·75	455·49
Besses Golden Maize ..	H. Stonex, Bell Block ..	1 249	240·5	321	5,707·4	406·06
Rosy Creek Peace ..	E. Griffiths, Cambridge ..	1 345	240·5	365	6,472·8	395·14
Peaceful's Lady ..	E. Griffiths, Cambridge ..	1 356	240·5	363	6,905·1	394·87
Oxford Silver Fox ..	G. A. Gammon, Marton ..	1 355	240·5	345	5,952·2	290·18
Riverswood Vanity ..	J. Nicolson, Kaupokonui ..	1 62	240·5	365	5,218·7	266·91
Senior Two-year-old.						
Diana Mahone† ..	C. Stevens, Maungatapere ..	2 226	263·1	365	8,107·3	472·17

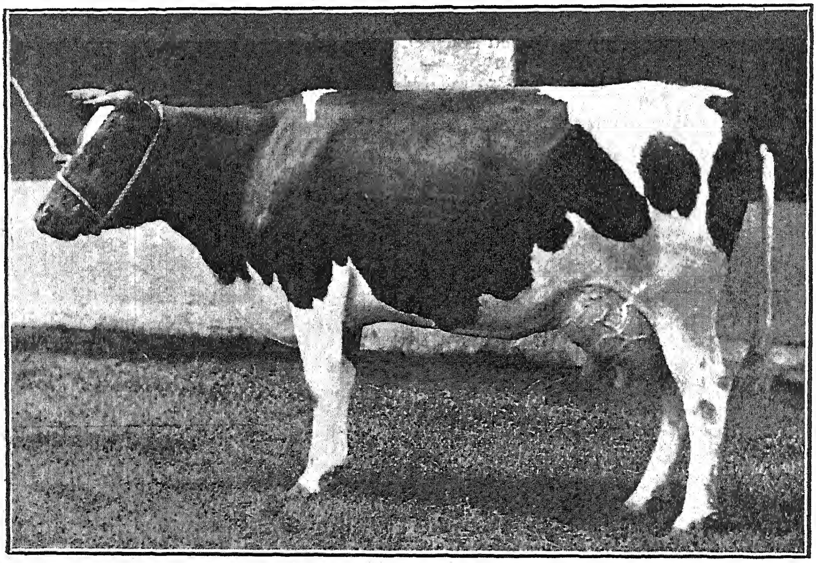
LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued*.					
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Hopeful Choice ..	W. T. Williams, Pukehou ..	3 136	290·6	365	8,582·4	514·72
Orange Dale Blossom	W. J. Hall, Matatoki ..	3 327	309·7	271	9,042·2	468·31
Top's Beauty ..	H. J. Burrell, Bunnythorpe	3 98	286·8	257	6,529·1	342·34
Daisy M. O. ..	F. E. Day, Tamahere .	3 199	296·9	365	4,503·9	317·21
Four-year-old.						
Highstead's Dairylike	F. E. Day, Tamahere ..	4 79	321·4	361	9,298·7	525·23
Genoa's Girlie ..	J. Cloke, Lepperton ..	4 264	339·9	308	8,392·5	441·62
Hawkesbury Rosebud	John Robb, Westmere ..	4 339	347·4	316	8,216·0	430·80
Heather Mahone† ..	T. Wells, Awakino Point ..	4 81	321·6	342	7,147·7	396·97
Mature.						
Halesworth Creamy ..	H. Peoples, Drury ..	5 198	350·0	365	12,405·0	661·35
Belvedere Daphne ..	E. B. Eagle, Greytown ..	6 24	350·0	365	12,853·9	615·27
Belvedere Lady's Joyce	E. B. Eagle, Greytown ..	6 341	350·0	365	10,969·9	596·77
Antonina	Taranaki Hospital Board, New Plymouth	8 281	350·0	364	11,877·8	595·05
Lavington's Briar ..	J. O. J. Oliver, Temuka ..	9 93	350·0	365	9,122·3	406·47
Mountain View's Fancy	Mrs. O'Callaghan, Tikinui ..	9 102	350·0	365	6,585·9	403·95
Rozel Grizette ..	W. T. S. Wilson, Otahuhu..	5 245	350·0	264	6,658·6	379·62
	FRIESIANS.					
Junior Two-year-old.						
Nettie Ollie Korndyke de Kol*	John Court, Ltd., Auckland	2 46	245·1	358	17,874·9	609·18
Rosevale Kaatje Colantha Posch*	North and Sons, Omimi ..	2 57	246·2	365	18,241·9	585·70
Hillside Mooie Blanco*	Mickell Bros., Te Horo ..	2 119	252·4	365	11,739·0	560·18
Rosevale Amelia Sylvia*	North and Sons, Omimi ..	2 60	246·5	365	14,754·2	472·85
Friesland Rose Queen†	P. Nesbit, Rata	2 154	255·9	365	12,034·0	406·44
Bainfield Freda Sylvia*	W. D. Hunt, Waikiwi ..	2 78	248·3	250	8,234·5	362·61
Winifred Mary Argyle de Kol†	S. Andrew, Kaikoura ..	2 17	242·2	365	9,151·9	346·63
Grambling Homestead Lassie*	John Court, Ltd., Auckland	2 72	247·7	342	9,784·8	297·96
Senior Two-year-old.						
Cordyline Griselda Lass†	Mrs. A. M. Hodgson, Tamahere	2 240	264·5	365	11,722·7	493·55
Ryvington Pontiac Colleen*	Mrs. A. M. Hodgson, Tamahere	2 193	259·8	365	13,499·0	433·30
Junior Three-year-old.						
Mapleshade Pietje Beets*	F. Smedley, Te Awamutu ..	3 31	280·1	365	16,320·4	566·53
Bloomfield Fayne Johanna*	R. C. Allen, Annandale ..	3 54	282·4	365	15,178·5	546·62
Betsy Blanco Beets*	F. Smedley, Te Awamutu ..	3 92	286·2	365	14,751·9	500·31
Senior Three-year-old.						
Pareora Janette* ..	A. S. Elworthy, Timaru ..	3 200	297·0	365	18,319·3	612·64
Rosevale Queen Sylvia Triumph*	North and Sons, Omimi ..	3 217	298·7	242	16,768·7	589·60
Woodlands Korndyke*	John Court, Ltd., Auckland	3 221	299·1	305	9,392·7	344·77



VICTORIA REGIA (F. J. FINER, NGUTUWERA).

C.O.R., 1925, in Jersey senior two-year-old class: 13,042·7 lb. milk, 643·61 lb. butterfat.



HINEMOA BEAUTY (T. R. EADES' EDENDALE).

C.O.R., 1924, in Friesian senior four-year-old class: 23,973 lb. milk, 822·37 lb. butterfat, 365 days.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
FRIESIANS—*continued.*						
Mature.		Yrs. dys.	lb.		lb.	lb.
Rosevale May Abbekerk*	North and Sons, Omimi ..	5 50	350	365	21,688·1	743·29
Springbank Tensen Pauline 2nd*	John Court, Ltd., Auckland	6 7	350	246	12,203·7	443·96
MILKING SHORTHORNS.						
Mature.						
Joyce 3rd of Cornwall Park*	R. S. Allan, Hatuma ..	8 9	350	365	18,986·8	709·13
RED POLLS.						
Two-year-old.						
Otahuna Nellie† ..	G. S. Young, West Plains ..	2 57	246·2	342	9,749·3	405·42

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
JERSEYS.						
Two-year-old.						
Airton Magicienne* ..	W. H. Waterhouse, Airton ..	2 20	242·5	351	6,752·5	356·41
Mature.						
Waitapu's Lady ..	E. Sinclair, Cheltenham ..	6 350	350·0	365	9,963·0	571·88
FRIESIANS.						
Senior Three-year-old.						
Pietertje Ormsby Mercedes Queen*	John Court, Ltd., Auckland	3 256	302·6	365	14,614·5	516·14
Mature.						
Burkeyje Sylvia Posch*	North and Sons, Omimi ..	11 215	350·0	365	27,161·4	864·38
Dominion Queen Elizabeth*	H. R. Green, Kairanga ..	9 96	350·0	365	20,615·5	733·61
MILKING SHORTHORNS.						
Four-year-old.						
Matangi Quality 4th*	Ranstead Bros., Matangi ..	4 190	332·5	365	22,010·5	978·47

STOCK SLAUGHTERED, 1924-25.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1925 :—

Stock.	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	149,549	247,883	..	90,706	488,138
Calves ..	41,221	22,775	..	3,311	67,307
Sheep ..	541,679	2,564,530	..	248,091	3,354,300
Lambs ..	71,338	4,832,493	..	19,542	4,923,373
Swine ..	100,043	142,168	37,714	27,849	307,774

DETERIORATION OF CROWN LANDS IN MID-WEST DISTRICTS OF THE NORTH ISLAND.

INVESTIGATION AND REPORT BY SPECIAL COMMITTEE.

IN November last a special Committee was appointed by the Minister of Lands, Hon. A. D. McLeod, to investigate the deterioration of Crown lands in the district covered roughly by the Whangamomona, Ohura, Waitomo, Otorohanga, Kawhia, Raglan, Kaitieke, Waitotara, and Waimarino Counties. The personnel of the Committee consisted of Messrs. G. H. Bullard, Commissioner of Crown Lands for Canterbury (previously Commissioner for Taranaki); F. O. Cameron, farmer, Hastings; E. P. Fowler, District Valuer, Masterton; P. Keller, District Engineer, Public Works Department, Taumarunui; E. B. Levy, Agrostologist, Department of Agriculture; and W. Roberton, farmer, Tahora.

The operative clauses of the order of reference for the investigation were as follows :—

(*a.*) Whether certain Crown leaseholds situated within the above blocks and counties are too large or too small for successful occupation by the present lessees, and whether relief could be given by surrendering certain unprofitable portions of such leases, and the best means for giving effect to such a recommendation.

(*b.*) Whether a contributing cause to the lessees' difficulties is the lack of formed access, and also due in part to the long distance they are situated away from railway or distributing centres. If the former, what recommendations are made for improving the position.

(*c.*) To report specially whether the lands are suitable for settlement, and whether the deterioration in pastures complained of in many cases is due to inherent natural and climatic conditions, or to the failure of the lessee to properly stock, surface-sow, and manure, or to improper methods, or to lack of capital.

(*d.*) To report as to the necessity for revaluation in view of present-day prices as compared with values ruling at the time of selection.

(*e.*) To report whether any concession, such as postponement or remission of rent for a specified period, is necessary to ensure the working of the lands profitably and put the lessees on a satisfactory footing.

(*f.*) Generally to report on and recommend as to the best method of dealing with these lands, with particular regard to means of coping with second growth, water-fern, &c., and generally as to what means are likely to be successful in again bringing such lands to profit, and the probably cost per acre involved.

(*g.*) To ascertain to what extent the Crown tenants have mortgaged their holdings, what is the rate of interest payable thereon, how much is mortgaged to the State Advances Office, and how much to private persons or firms, and to report whether any action is advisable in connection therewith.

REPORT OF THE COMMITTEE.

The Committee recently made the following report to the Minister :—

We covered the greater part of the area under review, and for the purpose of obtaining further information and evidence held meetings of settlers at sixteen different centres, and also took evidence from individual farmers *en route*, and from other persons interested or having knowledge of the various questions involved. The meetings were on the whole well attended, and much valuable information was derived therefrom.

NATURE OF THE COUNTRY.

The country under consideration may be divided into three classes : (*a*) Hilly forest country too steep for ploughing, and comprising the greater portion of the area ; (*b*) forest country containing a large proportion of ploughable land ; (*c*) open fern and scrub country, most of which is ploughable. The altitudes vary from sea-level up to about 2,000 ft., and the heights of the hills above the valleys vary up to 800 ft., an average being about 600 ft.

The soils are of the following types: Papa, sandstone, friable volcanic loams, and in places pure pumice, or mixtures of the above. In the Waitomo County there are large outcrops of limestone and rhyolite. The papa soils are the most fertile, but papa country, where steep, slips badly. The volcanic loams generally, with reasonable treatment, become profitable soils. Sandstone country is generally very steep and does not lend itself so well to treatment. Pumice soils are perhaps the poorest, and are difficult to grass except with special manurial treatment.

The forest cover varied according to quality of soil: (*a*) On the richer portions of the land tawa was dominant, associated with pukatea, white-pine, maire, matai, and mahoe; (*b*) on the easy average-quality slopes tawa was dominant, associated with rimu, matai, miro, rata, and totara ; (*c*) on the poorer, steeper, and harder country were tawhero, rewarewa, and hinau ; (*d*) on the topmost sandstone ridges were black-birch and tawhero mainly ; (*e*) on the open scrub country the natural vegetation consisted mostly of bracken fern, associated with tutu and, in places, manuka. Much of the country was covered by a spongy, peaty substance known as pukahu, most evident in wet tawhero country. The forests on the whole contained little milling-timber, although here and there some timber had been milled where the access was good.

NATURE OF DETERIORATION.

The deterioration complained of and markedly in evidence consists largely in a dying-out or in a replacement of the grasses and clovers sown, by various classes of fern, herb, and scrub growths—namely, bracken fern, hard fern, soft fern, wineberry, manuka, fuchsia, tutu, and hutiwai. The growth of these plants on the country does not necessarily indicate that the land is too poor to grow grass, but rather that there is a strong natural tendency for that country to revert back to its natural forest cover. The fern and scrub growths that make their appearance in the clearing soon after the forest has been felled and burnt constitute really the first phase in the succession back to forest. Nature all the time is endeavouring to win back the area to forest, and in a district of fairly good soil and heavy rainfall the advantage is all with the secondary growth. On areas where an intensely hot fire of the felled forest is secured the germ of the forest is entirely destroyed, and it is not until such time as seeds migrate on to the area that we see evidence of the forest re-establishment. In these latter areas it will be obvious that the grass-seeds sown on the forest-burn will have an almost undisputed reign, whereas that seed sown where the germ of the forest has not been killed will have immediate competition, and unless special judicious management is meted out the grasses sown have no hope of successfully competing with the uprising secondary-forest growth. Very few forest-burns within the above counties are sufficiently hot to kill the germ of the secondary

According to the heat of the burn and subsequent stock manipulation, the class of the secondary growth varies: (*a*) With a light burn and virtually no stocking, bracken, soft fern, wineberry, fuchsia, and lacebark predominate; (*b*) where the conditions are wet and the soil loose, usually carrying a mass of pukahu, and generally at higher elevations, soft fern usually predominates; (*c*) where the conditions are somewhat dry and the soil light and friable, and where only light cattle-stocking has been the rule, bracken and hard fern predominate; (*d*) where the bracken-fern growth has been largely kept under for some years, mainly by sheep, and where close and continuous grazing has been practised, hard fern and hutiwai (piripiri) are often extremely prevalent; (*e*) where the soils are poor, or where the fertility has been reduced by close and continuous grazing, and where an open sward prevails, manuka asserts itself—it may reappear rapidly on country previously carrying manuka, or it may follow as a subsequent association over hard-fern areas.

EXTENT OF DETERIORATION.

In the district under review there are (excluding soldiers' lands) about 1,990 Crown holdings, with a total area of 874,700 acres. Of these holdings, 75, with a total area of 42,905 acres, have been abandoned. The percentage of holdings abandoned is 3·77, and the percentage of area abandoned 4·9. It is impossible to obtain accurate information regarding the area and proportion of deteriorated lands over the whole area. The following statement is compiled from circulars returned by 310 settlers in the various counties, and may be taken as an approximate average and a fair estimate: Number of settlers who sent in statements, 310; total area occupied, 165,220 acres; area felled and grassed, 112,250 acres; area fairly clean pasture, 68,341 acres; area in second growth, 43,909 acres. The proportion of the reverted country to area felled and grassed is 39·12 per cent.; the proportion of country in fairly clean pasture is 60·88 per cent. Taking these figures as affording a fair average over the whole of the Crown holdings in the counties under review, we estimate that the total area of reverted country is 232,500 acres.

CAUSES OF DETERIORATION.

We consider the factors most potent in the bringing-about of this deterioration are as follows:—

(*a*.) *The wet climatic conditions prevailing, preventing hot burns—primary or secondary—and favouring a very strong and rapid growth of fern, &c.*

Climate is a big factor in the breaking-in of any hill country in New Zealand. The wetter and the milder the climate, the more difficult breaking-in operations become. In the first place, so much depends upon the initial burn, for unless a hot burn is secured the seeds and spores of the secondary growth, well and truly sown on the forest-floor long before the forest is felled, remain alive, and from these seeds and spores plants establish during the winter following the burn. In every shaded place where the heat of the fire has not penetrated, around logs, stumps, and in crevices, are myriads of young ferns—bracken fern, hard fern, and soft fern—in the prothallus and young sporophyte stages, and over the burn in general wineberry, fuchsia, &c., may come up quite

thickly. Thus right from the offset the grasses and clover sown have to compete with a strong volunteer growth. In a light burn, also, many logs are left on the ground, making stocking by either cattle or sheep difficult or dangerous unless very high costs are entailed in the tracking and logging-up of the burn.

A wet climate not only induces secondary growth, but also makes the control of that secondary growth difficult. Of the kinds of secondary growth that are most troublesome in the above counties, hard fern and soft fern in particular are surface-rooting, and if only a hot fire can be secured over this class the surface stolons are easily killed, and then that particular growth ceases to trouble. Again, shade is not inducive to the spread of any of those grasses and clovers which would migrate and form a turf over the country. Particularly is this true of danthonia. To ensure danthonia to spread, light must be allowed into the crown of the plant; and, without a doubt, where secondary growth is troublesome the cheapest way of removing the shade of the secondary growth is by the firestick. In a wet climate where the firestick cannot be satisfactorily used, then the more expensive implement, cattle, or the slashhook, must be employed to effect the removal of the shade of the secondary growth so that the danthonia and other grasses may spread.

(*b*.) *Insufficient fencing of the country, so that controlled stocking, particularly by cattle, could not be carried out.*

In most instances throughout the above counties the areas of forest felled at any one time have been on the large size compared with the ability of the settler to fence and sufficiently stock the area felled. As before stated, the germ of the secondary growth survives in most instances the heat of the fire. The grasses sown have this growth to compete with; and it must be said that we have in New Zealand at the present time no combination of pasture plants which in themselves are sufficiently aggressive to swamp out secondary growth. The two great factors in weed-control in our grasslands are (1) the formation of a close and continuous grass sward, and (2) the judicious feeding-down of that sward by different classes of stock. Stock judiciously managed are really the most potent agents in the control of weeds, and particularly is this true of cattle. On the ability or otherwise of the settler to stock his new burn with cattle depends, in nine cases out of ten, success or failure. Most of the ferns take, from spores, two to three years before they form anything like adult plants. During this period the treading of the cattle plays havoc with the young plants, and if only the whole of the surface could be cattle-tramped during the first few years there would be little fern-growth on that area. The presence of innumerable logs and stumps precludes this possibility, but the principle holds good for all parts of the burn that may be tramped by cattle. Cattle, again, consolidate the country and make possible, for grass, pukahu areas and other light spongy soils where, without the consolidation, the grasses simply wither off, leaving the area open to weeds. To effect this consolidation and to tread out the establishing ferns, &c., a heavy cattle-stocking is necessary; and farms have been visited where from one to two cattle to the acre for short periods have been maintained on the new burn during the first two or three years.

This gives some idea of the cattle-power necessary on certain areas; and unless the burns are fenced into comparatively small areas such

cattle-stocking is an impossibility. Again, many burns are not fenced at all from the neighbouring unfelled portion, and thus the settler has no control at all over his cattle, and as soon as the harder winter conditions come on, or as soon as the feed amongst the secondary growth becomes scarce, the cattle are liable to take to the bush. Again, stock of almost all descriptions will always hang on the warmer slopes or where the feed is sweetest, and it is not until these areas are fenced off from the shady or rougher portions that stock may be kept on these latter places. In order to bring back the deteriorated lands, fencing is an essential. No definite size of the paddock can be given, as this varies according to the size of the holding and to the cattle-power that the settler can bring to bear on any one area at the one time. Roughly speaking, 10 per cent. of the holding would represent the size of a good workable paddock. Thus on a 1,000-acre place the maximum paddock would be not more than 100 acres, and on a 500-acre place 50 acres would represent about the largest paddock that could be effectively worked. The secret of pasture maintenance and improvement, and of secondary-growth control, lies in the ability of the settler to heavily stock the area for a short period—to clear it up rapidly and then to spell. This intermittent hard grazing and spelling is not possible unless the farm is adequately fenced.

(*c.*) *Injudicious stocking; close and continuous grazing by sheep: failure to spell the country.*

It may be laid down as a fairly definite rule that close and continuous grazing, particularly by sheep, leads to an early running-out of the first-class grasses and clovers, and to an incoming of either low-fertility-demanding and light-loving grasses, such as danthonia and brown-top, or weeds, such as catsear, hawkweed, cudweed, &c., or hard fern, hutiwai, and manuka. In the country under consideration, in view of the light burn and loose nature of the country, it would appear that the stocking has been too much with sheep and not enough with cattle. Once the secondary growth makes headway, sheep will avoid those places where it is growing, but will keep close-grazed the grassed areas. The spread of hard fern, hutiwai, &c., is greatly encouraged through baring the grass turf to the ground. Sheep, no matter how forced, will not break into the patches of hard fern, &c. Crushing with sheep, therefore, but adds to the deterioration, inasmuch as, while little damage is done to the secondary growth, the heart is eaten out of the grasses and these become weaker and weaker. Cattle break into the secondary growth, and owing to their not being such close grazers as sheep the pasture grasses are not so weakened. The ewes and the dairy cows are harder on the country than are dry stock, and the former class of stock cannot be forced to crush out secondary growth, or to clean up rough pasturage, in the same way as can the latter. The change to dairying forced on many settlers during the slump has been attended with deterioration of virtually all the steeper and more difficult portions of the farm.

(*d.*) *Sowing of grasses and clovers not wholly adapted to the country.*

In the early days of felling and sowing country in the above counties the grasses mainly used were rye-grass, cocksfoot, red and white clover, with a good sprinkling in some cases of timothy, crested dogstail, meadow-foxtail, Poa trivialis, Poa pratensis, and alsike. Many

settlers still pin their faith to the cocksfoot and other first-class grasses, but there is a big leaning at the present time towards certain of the second-rate grasses and clovers, such as Danthonia pilosa, brown-top, and Lotus major; and paspalum on certain of the warmer slopes is advocated.

Excepting where areas have been very carefully farmed, or where the soil naturally is somewhat better, or where top-dressing has been practised, it must be said that the first-class English grasses and clovers are not holding. The rye-grass held good for two or three years and then it dwindled, leaving the cocksfoot as the dominant grass. Under certain conditions of grazing, the cocksfoot, associated with Poa pratensis, crested dogstail, and white clover (generally with a good deal of Yorkshire fog), persists, and just so long as the surface-soil fertility remains up to a certain standard this sward may be kept almost indefinitely; but under the system of hard grazing, generally close and continuous, by sheep the sward opens up and the pasture becomes a prey to weeds, unless such grasses as brown-top and danthonia are present and are spreading over the areas.

In the choice of species of grasses and clovers to constitute the pasture sward the farmer has two alternatives: (i) To use only the first-class grasses and clovers—mainly rye-grass, cocksfoot, crested dogstail, Poa pratensis, white clover—and by a system of spelling or by manuring maintain the fertility of the country so that these species are kept sufficiently vigorous to maintain a close cover over the whole of the hillside; or (ii) to use in addition to the above species grasses and clovers which will form a close turf over the country even though the soil-fertility may be considerably reduced—such additional grasses are Danthonia pilosa, brown-top, New Zealand rice-grass (*microlaena*), paspalum, ratstail, Lotus major, Lotus hispidus, subterranean clover, yarrow, and suckling-clover.

The first-mentioned grasses and clovers, provided they are kept strong and vigorous, will beat the ones below in production, but the cost of maintenance of fertility in order to keep them going will in most cases be extremely high, and often impracticable. More cattle will be necessary, more spelling of the country, which means more fencing, or artificial manures will have to be liberally applied. Once a sward of brown-top, danthonia, New Zealand rice-grass, ratstail, paspalum, &c., becomes established the country is cheap to maintain, and on hard and difficult country it would appear a sounder proposition to accept the lower-producing yet less costly sward rather than to attempt to supply the demands of higher-fertility-requiring grasses and clovers. Few hill-country farmers in other parts of New Zealand have managed to retain intact the first-class English-grass sward. Almost everywhere one sees creeping in one or another of the low-fertility-demanding grasses and clovers. This fact speaks for itself, for there is no doubt that if only the first-class grasses are kept growing strong and vigorous there is no fear of invasion of that sward by the lower-producing, inferior grasses. The maintenance of fertility is the decisive factor in regulating the composition of any pasture turf. Where the costs of fertility-maintenance are high, it is better to accept the second-rate, lower-fertility-demanding grasses and clovers; and where soil conditions are poor, and fertility upbuilding and maintenance are impossible owing to the topography and inaccessibility of the country, the acceptance of these second-rate grasses is the only safe course.

(e.) Depletion of fertility.

According to the standard of fertility maintained so will the composition of the pasture vary. The first-class grasses and clovers require a high standard of fertility, the second-class grasses and clovers a lower standard. Any farming practice that tends to reduce fertility has a deleterious effect upon the pasture sward. In the above counties, while the fertility due to the humus of the forest and the potash lasted, the rye-grass, cocksfoot, clovers, &c., grew luxuriantly. We feel that a good deal of the deterioration in the older pastures is the result of a gradual reduction in the surface fertility of the soil, brought about by close and continuous grazing, and by natural loss of plant-food by leaching, due to the constant rain and loose nature of the soil.

Indirectly, the following causes also are to some extent responsible for the deterioration :—

(f.) Boom and slump periods.

During the war period, and onwards to the height of the land boom, labour, grass-seed, and fencing-wire, and also stock, were very dear. This deterred many settlers from going on with improvements and purchasing stock, and those who went on with improvements during that period did so largely on borrowed money and greatly increased the indebtedness of their holdings. When the slump came many settlers were forced to sell their stock at heavy loss, and were unable, owing to lack of funds or credit, to purchase other stock, and in consequence second growth was allowed to grow unchecked. Even settlers who had their farms stocked received such low returns from them that they were unable to afford expenditure on improvement and maintenance.

(g.) High maintenance costs, these being in most cases too high for the unfinancial settler to keep up and live.

The felling of the natural forest, the surface-sowing of the seed, and the fencing are by no means the last cost in the farming of hill country, and particularly is this true of virtually all the country in the above counties. The cost of maintenance is a most important economic factor to be considered, for it is not until such cost has been accurately gauged that one can get any idea of the net earning-power of the land. In the older forest country, such as that of the Wairarapa, Hawke's Bay, Gisborne district, and that between Palmerston North and Taihape, when the forest was felled and the land grassed and fenced the settler's troubles were virtually at an end, as there was little or no secondary growth to contend with, and that which did come away was comparatively easily dealt with. From these lands, therefore, production has been maintained, and the maintenance costs have kept comparatively low, and could in most cases easily be met. In the case of the lands under our consideration the conditions are very different : the running-out of the grasses sown, and their replacement by fern and other rubbish, meant an early reduction in the profits of these lands, and throughout maintenance costs were steadily increasing. Where capital was available and judiciously applied the maintenance costs could be met before deterioration went very far, but on those farms where little or no money was available for maintenance the conditions went from bad to worse.

Any country troubled with secondary growth, and where that secondary growth cannot be regularly burnt, is expensive to get into grass and maintain. To ensure a pasture sward on any hill country the secondary growth, where any appears, must be periodically removed until such time as a close turf of permanent grasses and clovers is secured.

No grass turf will thrive well under dense shade, and particularly is this true of danthonia. On second-class hill country, until secondary growth is got rid of, a danthonia sward undoubtedly should be the objective. This means that in one way and another all shade-making growth must be cleared off. Where possible, the cheapest and quickest way of effecting this is by firing the area. Thousands of acres in New Zealand have been brought into danthonia by means of the firestick. Each fire lets in more light, and the danthonia spreads, and in many cases no reseeding is necessary. In the case of the country under consideration it is not possible regularly to fire the areas, and consequently sunlight has to be let in by more expensive methods—namely, by the use of cattle or with the slashhook. The danthonia or the brown-top sward existing at the present time on other hill-country areas of the North and in the South Island may be said to have been got very cheaply, and in many instances practically at no cost to the farmer at all. Over the country we are considering the danthonia sward will cost a good deal to become general, because of the cattle necessary, and inability to burn. Also, there is more resowing of seed necessary, and an inclusion of other grasses in the mixture that will tend to cover the ground until such time as the danthonia spreads and becomes general. Danthonia even under favourable conditions is slow to spread, and in very few places has a sward of this grass been secured in under ten years. Sowing of danthonia alone, therefore, is not a sound proposition where the return of secondary growth is rapid. Crested dogstail, brown-top, and Lotus major particularly, besides other grasses and clovers, should accompany all danthonia-sowings in the above counties. The seed of certain of these is expensive, which again adds to the maintenance costs of keeping that country clean.

(*h.*) *Lack of knowledge of local conditions.*

There is no doubt that the peculiar local conditions prevailing in the above counties upset the calculations of many settlers, even those of wide experience in the breaking-in and farming of other hill country in New Zealand—Hawke's Bay, Wairarapa, Rangitikei, &c. The forest indications and the early productivity gave promise that the country would break in well and would rank equal to or better than such hill country in other parts. The settlers went to work and felled the forest, and sowed the same seed-mixture that they were accustomed to in the district of their previous experience. Stocking was carried out in much the same way—namely, largely with sheep—and little fencing was done. Even where areas were well fenced the importance of cattle was not recognized. After some years the English grasses went out, *as they also have done in most other hill country in New Zealand ;* but instead of the vacant spaces in the pasture being seized upon by danthonia, brown-top, &c., which has happened in most other hill country, these became filled by pasture weeds, hutiwai, ferns, and scrub. We think failure to foresee this eventuality, and lack of capital to meet the eventuality when it arose, have helped in the present deterioration.

(i.) High rental values and high unimproved values.

The overestimation of the capabilities of the country, and the high goodwills paid on transfer since about 1908, have in many cases led to excessive rental values being credited to the land, and in consequence an excessive percentage of the returns that could otherwise have gone into improvements when the secondary growth was in its initial stages had to be swallowed up in meeting rent.

(j.) Difficulty of providing winter feed.

The difficulty of wintering stock at the present time, with so much steep country and so much still in the unstumped condition, is very manifest in certain blocks of country that were visited. Failure to carry sufficient cattle over the winter for the spring requirements is a big factor in the country having reverted so badly. The buying of cattle in the spring and having to sell again in the autumn, according to evidence given, resulted in a direct financial loss to the settler. The heavy death-rate of stock recorded in certain places is due in the main to their foraging in dangerous places, as the feed of the safer country gives out during the winter. It is essential that these losses through having to buy in the spring and sell in the autumn should be eliminated as much as possible by growing winter feed on any ploughable areas available, and by conserving feed by shutting up certain paddocks in the autumn.

(k.) Aspect and steepness of country.

The shady slopes and the steep, rough places are the first areas on the burn to revert to secondary growth. Both are alike in that stock avoid grazing there while they have access to sunny slopes or to easier country along the foothills.

(l.) Lack of formed access.

Bad access in the past, and in some cases at present, contributes to the settler's difficulties, increasing costs of development and expenses of running the farm.

(m.) Lack of capital.

It was almost universally said in statements made by settlers that lack of capital was responsible for the greater part of their trouble. Cheap money was said to be the crying need of the country. They realized now that more fencing had to be erected, that more cattle had to be kept, that more seed had to be sown, and that manure, where possible, had to be supplied. The question of raising money for the purchase of these was the great stumbling-block, for in many instances the land was already heavily loaded and lending institutions had tightened up considerably. A good deal of money must yet be spent on the country, and in the case of badly deteriorated areas there is little inducement given for the investment of private money. Undoubtedly the tightening-up of the money-market to these settlers has deterred much good work from being accomplished.

SIZE OF HOLDINGS.

In the case of the unploughable hilly land we consider that many of the holdings are too small to enable the settlers to make a reasonable living, and that the same class of land can be improved and worked

matter of fencing, building, &c., being considerably less per acre on larger holdings. We are of opinion that in the case of the land above described the minimum area generally should be large enough to winter about one thousand mixed sheep and one cattle-beast to 5 acres. We recommend that provision be made for the reclassification of these lands, and also of the freehold lands of similar description held under title subject to Part XIII of the Land Act, 1908, with a view to allowing an increase in the area of holdings where desirable. In the case of the ploughable lands, either bush or other country, we consider the present areas are sufficient. It would, however, be a great benefit to the settler who has at present only steep, unploughable land if he could secure in addition a piece of ploughable land. This would enable him to carry stock through the winter which he requires in the spring to keep his country in order.

In regard to areas of holdings which by reason of their poor quality and extreme steepness cannot at present be profitably improved, it would not be advisable in most instances to sever such portions, which are usually steep, high country at the back of the holding, and if severed would have no access. They would also be liable to become a breeding-ground for pigs and noxious weeds. The settler would control them as far as pigs and noxious weeds were concerned, and derive benefit from them as a source of supply of fencing-material and firewood. The planting of these portions by the settler might be worth consideration. We think, therefore, the best policy would be not to sever steep and unprofitable portions from the holding, but to reduce the rental of the unprofitable portions to a nominal figure and allow the settler to retain them. There are instances where these rough and poor portions adjoin Crown reserves, and where good fencing boundaries on severance would be obtainable. Provision might be made for severance in such instances.

ACCESS AND COST OF ROADING.

Part of the lessees' difficulty has been, and is still, due to bad roads, or none at all, and the distance of the holdings from railway-stations or distributing-centres. This adds to the cost of everything that goes on the place; and, where top-dressing is found to be profitable, good roads will lessen the cost of and encourage the use of manures. They would also in many parts enable fat lambs to be sent to market without waste, by motor-lorry, and thus enable the farmer to secure larger returns. It is considered that increased road subsidies to certain counties should be made. Some witnesses suggested that the payment of "thirds" should be continued for longer periods, and this would help to some extent.

The road-access question has always been somewhat of a stumbling-block. In an earlier period it was considered advisable to delay road-making to enable the settlers on the land to earn money; but in this class of country, where larger holdings should predominate, it is probable that a better policy would have been to do most of the roading before selection, as the settler usually has enough to do on his farm. Prior to 1913 it was not customary to load for roading at a greater rate than 5s. per acre, but in rough country this sum is quite inadequate. Provision has since been made for increasing the loading.

The area of occupied holdings, taking in both improved and unimproved land, in ten of these counties is approximately 2,792,000 acres, and an approximate estimate of the cost, including bridges but

excluding metalling of completed roads, is £3,020,000—much of them done more cheaply than at present. To complete unformed portions £1,740,000 would be required: this gives an average of £1 14s. per acre of occupied land. Some of this high cost is due to having to carry the roads through private and Native land as well as Crown land to reach the occupied Crown land. Prior to the war, roading-costs, without metalling, ran from £150 on the easiest country to £1,200 per mile on the roughest. These costs may now be safely doubled.

This gives an idea of the large sum required to road this class of country, and indicates the necessity of economy in the mileage. This does not mean that properties should always be large: they may be small on roads that are necessary; but extra roading should be avoided. if larger subdivisions will lessen it, where the class of land does not justify the rating necessary to pay interest on loans and maintenance. Many settlers urged the need of greater financial assistance than the present limit of £5,000 loan-money towards metalling in undeveloped counties where road-metal is scarce and consequently costly.

The improving of communication in these backblocks would assist in making the social side of the life more attractive, and induce more married men with families to take land; at present the lack of good roads, and the difficulty in obtaining adequate educational facilities, make residence on this class of land hard for the womenfolk.

We would recommend that in newly settled districts like these under consideration, where a large amount of developmental work has to be done, where roading is difficult and costly, and metal scarce, it would be reasonable to give local bodies a larger limit of borrowing-power from the State Advances Department than older-settled districts, and a more generous contribution in the way of subsidies for metalling —say, £2 for £1, instead of £1 for £1 as at present.

It is hopeless a settler trying to succeed without a 12 ft. road to his property, and the Government should provide this or say definitely that it will not do so. In the latter case some compensating arrangement should be made with the settler who has been patiently waiting for his access for so many years; in some few cases, twenty years after the land has been alienated, some of the roads are still unformed.

SUITABILITY OF THE LANDS FOR SETTLEMENT.

In view of the large amount of capital already spent in felling, grassing, and roading, &c., caution should be used before abandoning any of this class of country. In our opinion a small portion of the poorest and roughest country is not worth trying to farm. At the same time, the second-class grasses have not yet had sufficient trial, and it is desirable that work of an experimental nature be carried out on this class of country by the Crown. In the meantime the disposal of this class of land should be held in abeyance. The question of deterioration has been dealt with under that heading.

NECESSITY FOR REVALUATION.

Revaluation is advisable in consequence of the change in circumstances since many of the lands were selected. When this took place in many cases the difficulty of maintaining fertility and controlling second growth, and the liability to reduction in carrying-capacity, were not generally recognized, as the forest indications were similar

to those in districts where country turned out well and was broken in with much less difficulty. Costs of development have also increased out of proportion to the returns. Bushfelling, for instance, has risen from £1 5s. to £2 or over, and fencing in the same proportion to £2 or more per chain.

One factor that induced high valuations was the goodwills that in instances were paid on transfer. Tenants complained of want of uniformity in Crown rental valuations. Generally, the rental values previous to 1908 were not unduly high, and it is not apprehended that much reduction will be necessary in the case of blocks opened prior to that date. In the case of blocks opened subsequently to that date, values of some blocks should probably be reduced considerably. The fact of the country being opened up more, and the experience of intervening years, will render practicable more uniform and reasonable valuations. The lowering of rents on revaluation will not amount to enough to remedy the situation altogether, but it will afford a measure of relief to many harassed settlers.

Among the causes justifying low rental valuations on these lands are the liability to second growth, and the high cost of maintaining pasture through the loss of cattle used for crushing in earlier stages; the lower price for bush wool; and the lack of formed access, making the cost of everything high at the start, thus bearing hardly on men of small means. There is also the liability of failure of burns in a wet season. The cost of medical attention is another item that occasionally bears heavily on pioneer settlers. Much of the lands under consideration was cleared and sown when costs were much lower; but, since about 1912, development charges have been rising rapidly, and it is now estimated that to properly fell, sow, fence, erect buildings, and otherwise improve bush land will cost about £6 or more per acre.

POSTPONEMENTS AND REMISSIONS OF RENT.

We are of opinion that in many cases remissions of rent for any period up to five years will be required, and also think that actual remissions for a period would be better than postponements of larger amounts for longer terms. Such should only be given subject to the amount remitted being spent either on fencing, manuring, seeds, clearing, or other land-improvements to the satisfaction of the Department. In many instances the settlers are so heavily involved that any assistance is futile until a large proportion of their indebtedness is written off. Any assistance given should be contingent upon the mortgagees, State or private, reducing mortgages or remitting or lowering the rate of interest. In granting assistance of any kind the merits of each individual case would have to be carefully considered.

EXTENT TO WHICH CROWN TENANTS HAVE MORTGAGED THEIR HOLDINGS.

In the district under review there are (excluding soldiers' land) about 1,990 Crown holdings, with a total area of 874,700 acres. Of these holdings, 75, with a total area of 42,905 acres, have been abandoned. The percentage of holdings abandoned is 3·77, and the percentage of area abandoned 4·9. It is impossible to obtain accurate information regarding the area and proportion of deteriorated lands and the financial position of settlers over the whole area. The following statement is compiled from circulars returned by 310 settlers in the

various counties, and may be taken as an approximate average and accepted as a fair basis for estimation :—

Number of settlers who sent in statements	310
	Acres.
Total area occupied	165,220
Area felled and cleared	122,250
Area fairly clean	68,341
Area in second growth	43,909
	£
Government loans—Stock	9,275
Government loans—Land	226,996
Private loans—Stock	67,679
Private loans—Land	221,818

	£	s.	d.
Advances on land per acre over total area (165,220 acres)—			
By State Departments	1	7	6
From other sources	1	6	10
Total indebtedness per acre on land	2	14	4
Advances on stock, per acre—			
By State Departments	0	1	1
From other sources	0	8	2
Total indebtedness per acre over total area (165,220 acres)	£3	3	7

	£	s.	d.	£	s.	d.
Advances per acre on total area of felled land (112,250 acres)—						
By State Departments	2	0	5	0	1	7
By private firms	1	19	9	0	12	0
Total indebtedness per acre	£4	0	2	£0	13	7

	£	s.	d.
Total indebtedness per acre on 68,341 acres fairly clean land, including stock	7	14	0

	Per Cent.
Proportion of the reverted country to area felled and grassed	39·12
Proportion of the country fairly clean to area felled and grassed	60·88

Money lent by the State, if on the same ratio as above, on an area of 874,700 acres would be £1,209,000 ; and from private sources an almost similar amount, £1,174,000, is involved. This makes a total of £2,383,000 ; and to this must be added £493,500 for stock mortgages. Besides money lent on Crown holdings, different Government Departments have securities in the same districts on freeholds and other tenures, so that the Government is concerned with this phase of the question as well, where it guarantees such funds.

METHODS OF DEALING WITH SECONDARY GROWTH.

There are four main methods of dealing with the secondary-growth problem, which methods more or less overlap and are interdependent the one on another. These are—(i) The use of cattle, and necessary fencing to control the cattle-stocking ; (ii) resowing with low-fertility-demanding grasses ; (iii) top-dressing with artificial manures, spelling, &c. ; (iv) direct manual labour in cutting, burning, &c.

The use of cattle, the need of fencing, the advisability of using low-fertility-demanding grasses have been previously discussed. The wonderful results that have followed the top-dressing of worn-out grassland in many parts of New Zealand have led to a general idea that in top-dressing lies the salvation of the secondary-growth grasslands of

the North. There is no doubt that top-dressing, rationally carried out, will prove of great value, but just how, when, and where top-dressing should be done is hard to answer satisfactorily. Top-dressing of weak grassland and of any portions that are moderately well grassed appears to the Committee to be sound under nearly all circumstances. Top-dressing will increase the feed produced and thereby increase the stock carried. Top-dressing increases palatability, and therefore it acts as a draw to stock. If stock can be drawn on to secondary growth in increasing numbers by top-dressing, then top-dressing becomes a most important factor for the control of secondary growth. On certain of the steep country where the pasture has virtually gone, several applications of manures will have to be made before a marked improvement of the country is shown. This will involve a heavy expenditure, which the settler in his present condition can hardly stand. Manual labour is necessary to deal with manuka, wineberry, &c., that cannot be kept down by stock.

COSTS OF GETTING REVERTED COUNTRY BACK.

Costs of getting the reverted country back into profit are extremely difficult to arrive at, as so few settlers have tackled and successfully grassed large areas that had reverted. The costs of regrassing also depend very largely on the seasons experienced and on the class and density of the growth to be dealt with. There is no doubt that if the country were swept over by a Raetihi fire the costs of getting the country back into grass would be considerably reduced. As the seasons are at present, a good deal will have to be spent actually in the cutting of secondary growth.

	£	s.	d.		£	s.	d.
Felling manuka, wineberry, &c. (£1 5s. to £1 15s. per acre) ..	0	2	6	to	0	3	6
Seeding	1	5	0		1	5	0
Fencing	0	7	6	to	0	15	0
Average cost per acre ..	£1	15	0	to	£2	3	6

Given a really dry burning season, a great portion of the reverted country could be brought back to profitable condition for little more than the cost of grass-seeding and repairs to fencing.

Each succeeding year up to about the sixth year there will be a small recurring cost for the felling of reappearing manuka, &c. Every four to six years hard-fern patches will in all probability need burning and a further sowing of seed. With danthonia, Lotus major, and brown-top spreading into the patches, these costs will probably be greatly reduced as time goes on.

Certain of the bracken-fern areas are being brought in by crushing with cattle, but the expenditure in connection with cattle losses is almost impossible to estimate on the data secured. Top-dressing as a factor in control, with manures and cartage at their present figures, will mean a high annual expenditure on the land. For the first application only little extra stock might be carried on the poorer, steeper, run-out portions. Two hundredweight to 2½ cwt. manure per acre applied to the land annually would cost about £1 per acre. The first two or three years of top-dressing the poorer run-out lands must

be regarded as a necessary expenditure to get the land back to form. Once the sward is well established again, top-dressing, to be an economic practice, should then pay for itself and show a profit in the increased stock carried. On the better papa slopes and on any fairly well grassed country top-dressing undoubtedly would pay for itself right from the offset.

FURTHER RECOMMENDATIONS.

1. *Extension of Time to freehold O.R.P. Holdings.*—The time allowed under the Act to freehold a number of these holdings will shortly expire, and some settlers stated that under their present financial circumstances they are unable to exercise the right of purchase. We recommend that consideration be given to extending this right for a period of, say, ten years.

2. *Financial Assistance.*—In addition to remissions of rent for specified periods, other financial assistance is necessary. In a great many cases many settlers have not been able to meet their obligations as far as their rent and interest are concerned. We recommend that a special fund should be provided to assist settlers in the purchase of commodities such as fencing-wire, grass-seed, manures—all of which are essentials in the bringing-back of these lands.

3. *Royalty for Destruction of Pigs.*—There were in some districts numerous complaints about the depredations of wild pigs in destroying lambs and rooting up good pastures, and we recommend that the payment of 1s. per snout, already paid in some districts, should be made general throughout the whole district under consideration, and for the whole year round.

4. *Free Railage on Manures.*—Much could be done to help settlement on these lands if settlers were enabled to manure. The cheaper the landed costs of manures the more will be used; and to encourage their greater use we recommend that manures be carried free of charge on the railways for *bona fide* settlers in the areas under consideration.

5. *Fencing Boundaries adjoining Crown Reserves.*—We recommend that some consideration be given to settlers whose lands adjoin Crown reserves in the matter of boundary-fences. This consideration could be given by an allowance in the rental, or by actual financial assistance in the erection.

6. *Research Work.*—We recommend that the Government assist generally by carrying out research as outlined below; and by lectures, field demonstrations, pamphlets, &c., do all in its power to gain and disseminate knowledge on the best and most profitable ways of farming these lands.

It was patent at the meetings and on the settlers' farms that the settlers themselves were seeking to gain information as well as to give. This problem of grassing steep forested country is comparatively new to the pastoral world, and the wonder of it is that so much of our hill country has been so successfully grassed. Up to the present the settlers themselves have worked out their own salvation. When the land was taken up originally neither the Department of Agriculture nor the Department of Lands had any exact information to give on grassing and managing the hill-country lands of New Zealand. Recently experiments have been started in a small way in the Whangamomona County, and while these in themselves are excellent, yet the whole question of hill-country farm management

and farm economics should be the subject of an exhaustive research by the Government. Experimental work on hill country is not a matter of small plots: whole paddocks, and in certain instances whole farms, should be taken over and treated and kept under close supervision by scientific men trained to the work.

Some of the leading problems calling for investigation are—(i) Study of exact conditions that determine dominance and succession in secondary growth; (ii) an exact study of all known pasture species on the various soil types, and a trying-out of new and additional species, should be undertaken; (iii) thorough study of the economics of cattle as a means of secondary-growth control; (iv) study of general methods of management; (v) costs of maintaining the country; (vi) study of methods of fertility upkeep.

The hill grasslands comprise some 11,000,000 acres, approximately 75 per cent. of the total deforested lands in New Zealand. Of this area during the last eight years, according to official statistics, approximately 1,100,000 additional acres have reverted to fern, scrub, and secondary growth. To try to stay this deterioration, expenditure on research work is amply justified. Necessary funds and men should be forthcoming so that this work is in no way hampered, and provision should be made not only for the immediate future, but for a period extending over not less than ten years, so that a sustained effort at carrying out this important piece of work could be made. A few good men forming a small branch of the Fields Division of the Department of Agriculture, working in conjunction with the field officers of the Lands Department, could do invaluable service to the country at the present time.

POSSIBILITIES OF THE COUNTRY.

The report, as set out above, is necessarily bristling with the word "deterioration," and the Committee feels that some injustice may be done the country as a whole without some word as to the possibilities of the country once it is shown that the area can be successfully brought back to grass. Generally speaking, it may be said that strong growth of secondary scrub, &c., tells of possibilities in the country rather than of impossibilities. The very factors that favour strong secondary growth alike favour good grass-growth once the sward is established and once the secondary growth is controlled. The country generally is well watered, and healthy for both sheep and cattle. A surprising feature in the deteriorated grasslands of many of the counties is the really high carrying-capacity of the land actually carrying grass. We think it is not too much to say that, once the country is sufficiently fenced and the secondary growth cleaned off, one to one and a half mixed sheep per acre, besides cattle, is not too high a carrying-capacity to expect over the majority of the country. With manuring, more could be carried. For some years the cost of maintenance will undoubtedly be high, but as the country ages, and as stumps, logs, pukahu, &c., rot away, difficulties and maintenance costs will gradually decrease—that is, just as long as the areas remain in occupation and the settler handles his country properly Here and there are to be seen in a fairly clean condition successfully managed farms which stand out in contrast to much of the other land in the vicinity.

[NOTE.—An appendix to the foregoing report will be published in a later issue of the *Journal*.]

SEASONAL NOTES.

THE FARM.

SPRING CULTIVATION AND FORAGE CROPS.

As soon as the land is dry enough in August ploughing and general preparation for spring crops should be pushed along with a view to sowings during the latter part of the month or early in September.

Special hay or ensilage crops: Where the situation is warm and likely to suffer from dry weather early in summer it is good policy to get these crops in towards the end of August, but in most situations from the middle to the end of September is quite early enough. Suitable for this purpose are mixtures of Algerian oats or wheat with tares or peas—2 bushels of the cereal to 1 bushel of the legume. For spring sowing golden tares are the best, but if there is any difficulty in procuring these the ordinary grey tare is quite satisfactory. In peas Early Minto, Grey partridge, or Imperial blue may be used, their merits generally being in the order named. In localities where tares or peas do not grow very well it is advisable to sow 1½ bushels per acre. Suitable manures for this class of crop are basic super, or mixtures of super and Ephos, slag, or Nauru phosphate, at the rate of 1 cwt. to 3 cwt. per acre according to the condition of the land. If the land has been recently limed, super will probably be the best. Another suitable crop is Western Wolths and Italian rye-grass, 15 lb. each, together with 6 lb. of cow-grass.

Sheep feed: Oats and mustard (2½ bushels to 3 bushels of the former and 5 lb. or 6 lb. of the latter per acre) may be sown in August for ewes and lambs, to be fed before the first rape is ready. In Southland a mixture of Emerald rye-corn (2 bushels) and Western Wolths (12 lb.) has been found very useful.

WHEAT AND OATS.

The extremely wet conditions prevailing during June will have prevented the winter sowing of large areas of cereals in Canterbury. The land already prepared in most cases will have settled rather badly, and before drilling is carried out a deep cultivation will be necessary to permit of a good seed-bed and ample æration. Except in the milder districts near the coast, the sowing of wheat and oats should be left until favourable conditions in August and September. The earlier spring sowing should be done while soil conditions will permit, and growers will be wise to use at least 1 cwt. per acre of high-grade superphosphate or basic super. The shorter period of growth of spring-sown crops calls for the use of these more soluble phosphates, as quick development of a good rooting-system to help in overcoming dry conditions which may set in is essential.

Later in August the rolling of autumn-sown crops should be carried out. Frost-lifted ground will dry out very quickly, and deprive the roots of that close contact with the soil which is necessary for enabling the plant to derive the maximum benefit. Rolling should be followed by harrowing in all cases, for once having compacted the soil it is just as desirable to prevent, as far as

possible, any loss of moisture by evaporation. The harrowing will provide the surface mulch which, itself being loose, will dry quickly, but will prevent further excessive evaporation from the lower soil. Excessive evaporation means loss of warmth as well as loss of moisture, and both require conservation in the spring.

PASTURES.

Quick returns for money invested in manures is always desirable, and if benefit from top-dressing is desired in the current season August should be the latest month for application. Preference should now be given to super, basic super, or a mixture of super and lime. Every farmer should be his own experimenter as far as is practicable, and no operation such as top-dressing should be done without having a strip or two in the paddock left free for comparative purposes.

Pastures should be given a thorough harrowing with the tripod or chain harrows during the coming month.

FEEDING-POINTS.

Where green forage crops have been provided they will prove of great value for cows that have come into profit early, also for newly lambed ewes. To make the best of the crop and ensure the best results from the stock, considerable care is necessary in feeding at this time of the year. When feeding off, the stock should only be allowed on the crop for twenty minutes to half an hour during the first few days; if the supply is ample this may be increased to one hour at the end of a week. If available, hay or some roughage should be fed before the stock are allowed on the green fodder; most stomach troubles will then be avoided.

Crops of Thousand-headed kale and Chou moellier are best cut and allowed to wilt for a day before being fed out. In this condition cows do better on the fodder, and the danger of red-water is avoided.

Mangolds make excellent feeding for both sheep and cattle, provided they have been properly ripened. It will often be found that they ripen unevenly, and care should be taken when carting out to select the ripest, throwing the green roots back and giving them a further chance to mature. When mangolds have been carted out on a field for ewes the latter will generally select the ripest roots themselves. Dairy cows should be started with 20 lb. per day, and this may be increased to 50 lb. or 60 lb. per day; any quantities over this are more or less wasted.

Hay should be fed before roots of any sort, but especially before mangolds. Care should be taken to feed roots on a clean pasture; the consumption of quantities of earth is bad for any animal.

MISCELLANEOUS.

Cultivation of lucerne may still be carried out to advantage during the coming month before any marked growth is made by the crop. Spring cultivation is particularly desirable after such an excessively wet period as has been experienced this winter in most districts.

A few pounds per acre of cow-grass distributed over autumn- or winter-sown wheat at this time will often be found very profitable, providing a fresh bite after harvest while cleaning up the stubbles and later to be ploughed in.

—*Fields Division.*

THE ORCHARD.

THE SPRAYING PROGRAMME.

When these notes appear pruning operations should be well forward in order that other seasonal work may be carried out as it falls due. Spraying will be the most important work to be done during the next few months. Every grower should now be preparing his spraying programme, and, moreover, comparing it with the one of the previous year. The results obtained will enable him in some measure to amend and alter his programme to suit the conditions under which he is working. Where new and untried compounds are placed on the market, these should be treated with caution until such time as they have been proved by some reliable person or persons. The various specifics that have been in use and recommended for many years have stood the test of time, and in the main have given satisfaction. Moreover, they will (if used in an intelligent manner) control the various pests and diseases. The fact that at various times failure has resulted where the well-known spraying formulas have been used in no way reflects adversely upon their effectiveness. Although certain modifications may be necessary in time of application and strength at which to apply, the points which follow will serve as a guide for the next few months.

CONTROL OF FUNGOID DISEASES

For the control of fungoid diseases such as leaf-curl, shot-hole, bladder-plum, &c., all stone-fruit trees should be sprayed with bordeaux mixture (8–6–40) as soon as the buds commence to swell. Great care must be exercised in making the application in order that every portion of the trees shall be completely covered, paying particular attention to the young twigs. Bordeaux should be used immediately after it has been made, as it deteriorates rapidly, and is stated by competent authorities to have lost approximately 50 per cent. of its efficiency after standing eight hours. Apples and pears should receive an application of red oil (1 in 10 to 1 in 15) at the end of August or early in September. Pears should be sprayed first, as the buds are more liable to injury than those of the apple. Bordeaux will not control blister-mite on the pears, and it is therefore necessary for them to be sprayed with an insecticide for its control.

For the control of black-spot on pears the following applications of bordeaux should be given: 5–4–40 at tight-cluster, 4–4–40 at pink-cluster, 3–4–40 at petal-fall. As Winter Cole is rather subject to scorching, it should not receive bordeaux after the pink stage. This variety is not very subject to black-spot, therefore no harm will result by deleting bordeaux after the pink stage. On most varieties the last-named application will have to be repeated at intervals of from fourteen to twenty-eight days, according to the amount of infection threatening. As the spores of black-spot develop more rapidly under moist conditions than under dry, it will be necessary to make the applications more frequent when the weather is damp.

Apples will need the following applications of lime-sulphur for the control of spot, mildew, &c.: 1–10 to 1–15 at early green-tip, 1–40 at pink, 1–100 at petal-fall. Where it has not been possible to make the first application of lime-sulphur (1–10 to 1–15) it would be wise to substitute it with 1–25 at tight-cluster and then eliminate the pink

spray. With those varieties very subject to spot, such as Delicious, Dougherty, Ballarat, &c., bordeaux (3-4-40) could be used at tight-cluster.

Complaints have been made that Cox's Orange and Delicious will fall heavily if sprayed with lime-sulphur at petal-fall. This may be overcome to a large extent by substituting a combination with atomic sulphur in either of the following formulas: $\frac{3}{4}$ gallon lime-sulphur, 4 lb. atomic sulphur, 100 gallons water; or $\frac{1}{2}$ gallon lime-sulphur, 7 lb. atomic sulphur, 100 gallons water. It has been demonstrated that atomic sulphur combined with lime-sulphur prevents burning.

To a large extent the control of all fungoid diseases should be of a preventive nature.

MANURING.

This is work that should be kept in view at the present season. The trees, being in permanent possession of the soil, take out year after year the same constituents. These need to be restored to the soil, otherwise it would soon become exhausted and poor results would be obtained. It has been definitely proved that judicious manuring pays well in all classes of production. If farmyard manure can be obtained it supplies all that is necessary. Where it cannot be procured artificial fertilizers can be used with good results. Superphosphate, sulphate of ammonia, and sulphate of potash will supply all that is required, using them in the ratio of three of the first to one each of the two others. This manure should be applied during August, in order that spring rains may take it down into the soil. Should the land be deficient in plant-food in the form of humus, this should be supplied in the form of cover-crops grown each season and ploughed under. This, together with an occasional dressing of lime, should keep the orchard-trees in good condition and enable them to bear consistent and regular crops of high-grade fruit.

—*L. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

Harvesting.—Oranges (Poorman and sweet) should be harvested as ready. With both it is advisable to get good maturity. Many oranges are picked at the first tinge of yellow, but with sweet oranges this is too early to give good quality. A well-developed colour covering the whole surface is required before the fruit is ready to pick for the local market, while the real quality fruit for the best trade is that which is allowed to remain on the tree to fully mature. Poorman and marmalade oranges may be harvested when a fair proportion of colour is showing and good size attained. Where these varieties are being grown for sale as breakfast fruit more maturity on the tree will give better dessert quality and tend to increase the popularity of this fruit and its use for that purpose.

Planting.—All kinds of citrus-trees may be planted from now on. The essential factors are: (1) The soil should be in good order at time of planting—that is, not sticky; (2) the trees should be planted firmly, but the surface soil left loose; (3) the plants should be supported by a strong stake, inclined towards the prevailing wind; (4) the stake—not tree—should be bound with sacking or like material to prevent chafing; (5) long extensions or unshapely growth should be cut back to shape the tree and restore balance between top and roots, many of which have been destroyed as the trees were lifted.

Pruning.—The pruning advisable at this period will mainly consist of the removal of cross-wood, surplus growth, and worn-out parts. Cross-wood is, of course, to be avoided in any part of the tree-formation, as it gives rise to bark-chafe, with consequent check of sap to such parts—apart from the fact that injured wood provides a ready entry for borer. Surplus wood may usually be found on the inside of trees — soft, rank water-shoots and other adventitious growths which create a dense condition. With the orange their removal is not so important, for the fruit is carried round the fringe of the tree; but, even so, an open condition rather than density should be aimed at, as a circulation of air and easy access for sprays are desirable for keeping the tree healthy. With the lemon, as fruits are carried throughout the tree, a large area can only be kept in fruiting-condition by so keeping the tree open as to allow sunlight and air easy penetration throughout. Worn-out parts consist of twigs and branches which have become unduly extended. These should be shortened back to a well-placed lateral or small bud, to induce more desirable young growth. Also, short twigs which have fruited and show decline should be cut out clean to active wood, not only because they are of no further value, but because if allowed to remain they prove the usual point of borer-entry. Any branches which are inclined to sweep the ground should also be shortened back to give a good clearance—say, 18 in. at least. All cuts made on wood over $\frac{3}{4}$ in. in diameter should be coated with coal-tar. This is a good safeguard against decaying fungi and wood-rot, and well repays for the little extra labour involved.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

EXPORTATION OF EGGS.

THE egg-export season being near at hand, a few hints regarding the class of egg most desired for the export trade may prove helpful. In this respect it may be mentioned that since the initiation of export two seasons ago there has been ample evidence to show that the great majority of poultry-keepers have much to learn in regard to collecting and forwarding their eggs to the grading-stores. With too many producers an egg is an egg and nothing more, there being little consideration given to its freshness or external appearance. Such methods of marketing eggs may pass for the local market, where there is no outside competition to contend against, but with the overseas trade it is entirely different. In the latter case our eggs have to face world-wide competition.

In the past two export seasons the great drawback has been the high overhead charges connected with preparation of the shipments. Had the great bulk of the eggs received at the grading-stores been in a fresh, clean condition, these charges would have been considerably reduced. As it was (especially at certain of the stores), more than 50 per cent. of the eggs proved to be unsuitable for export, and therefore had to be rejected. This was chiefly because they were stale or in a dirty condition. Indeed, it is safe to say that many of the lines referred to were never intended for export so far as the producers were

concerned. In the circumstances those in charge of the egg-collecting depots—namely, egg-circle agents and others—must share blame with the careless producer for the unsatisfactory state of affairs which existed.

If overhead charges are to be reduced to a minimum during the coming season, and the export trade is to be made really payable, it is of the first importance that those concerned shall appreciate the necessity of internal quality and of cleanliness. Notwithstanding the special care taken by the graders in sorting out the clean eggs from the dirty at the stores, an extract from a trade report regarding some of last season's shipments reads, "The shells were much cleaner than those of the 1923 shipments, although there is room for improvement along this line to compare with high grades from continental countries."

Those who intend exporting eggs during the coming season should secure from the Department a copy of Bulletin No. 106, which is supplied gratis and gives useful points for the guidance of producers regarding the exportation of eggs. Supplementary to this bulletin the points which follow may further assist towards the desired end.

Cleanliness.

Dirty eggs cause more trouble and annoyance at the grading-stores than practically all other things put together. To ensure clean eggs the nests and nesting-material should be kept clean; also, where possible, the hens should be confined to the house on wet days and when the runs are in a muddy state. Pine sawdust or, better still, clean sand are excellent nesting-materials, especially where kerosene-tins or nests without cracks are used. These act as an absorbent where the birds enter the nests with soiled feet, and tend to prevent the eggs from getting dirty. Another advantage in using sand or sawdust is that, should any adhere to the shell, it can be easily brushed off.

Eggs for export should not be washed. By means of a soft cloth damped with lukewarm water any dirt adhering to the shell can be easily removed. The egg should be rubbed as lightly as possible, so as not to remove the protective covering, which has much to do with its keeping-quality. Dirty cloths or dirty water should never be used, as they give the eggs an old, stale appearance. Eggs should be cleaned as soon after being collected as possible; the longer they are left the more difficult will it be to remove the dirt. Cleaning eggs is a slow process, and the poultry-keeper should aim to prevent having to clean them.

Eggs should never be put into the carriers until they are properly dry, as any dust on the fillers or trays will adhere to the shells, making them unsuitable for export. The fillers, flats, trays, &c., should be well dusted before the eggs are placed therein. Unless eggs are perfectly dry, newspaper should not be used in the packing process, as the printer's ink will adhere to the shells and spoil them for export.

Eggs intended for export should be packed in closely boarded carriers, not only in order to keep them free from dust during transit, but also as a preventive against the air-cell drying down. To guard against this they should also be stored in a cool place. It should not be forgotten that evaporation of moisture from the egg commences immediately after it is laid. Obviously, the cooler the place in which it is kept the slower will the drying-down process be.

Freshness.

Eggs for export should be strictly fresh, as after a week old they are apt to be rejected as stale. To ensure freshness—especially during warm weather—they should be frequently collected. Allowing eggs to be sat and trampled upon by several birds when visiting the nest to lay not only injures the content, but also has the effect of giving the shells a dirty, unsightly appearance.

Size of Eggs.

Generally speaking, throughout the country there is a tendency towards smaller eggs, and the chief reason for this is that sufficient care has not been taken to eliminate the small egg when selecting eggs for hatching-purposes. The desire for numbers instead of quality is largely responsible for this careless policy. In mating the breeders it is especially important to know that the male bird has come from a hen which laid a good-sized egg, for, however satisfactory may be the size of the eggs of the female, the progeny will probably fail to maintain a good egg-standard if the sire is the descendant of stock the eggs of which were of an undesirable size. It has to be remembered that the male bird influences perhaps hundreds of the progeny, whereas a hen will influence only the chickens which have come from the eggs she laid.

There could be no better means of correcting this undesirable tendency than by introducing a system of selling eggs according to their weight. Under the present crude system of marketing there is no inducement for a producer to breed for good-sized marketable eggs, obviously for the reason that he is not recompensed in money value for the trouble taken. I recently received a communication from a producer who stated that one strain of birds in his flock mostly laid eggs 2¼ oz. in weight, and asked what could be done by way of feeding or mating to reduce the size of the eggs produced, thus securing greater numbers from these particular birds. He pointed out that the local egg-circle gave the same price for eggs weighing 1¾ oz. as for 2¼ oz. product. Of course, I am not advocating the production of very large eggs, but the egg specially desired for the export trade—namely, 2 oz. in weight, or slightly over. It is true that the egg-laying competitions are doing a splendid work for the uplifting of the Dominion egg-standard, as in these tests no bird or pen of birds, as the case may be, that lays an undersized product is eligible for prize-money. So long, however, as eggs are sold by the count, irrespective of their size, and at an equal price, such must obviously help in no small way to undermine the object aimed at by those who control these competitions.

The worst feature connected with the small-egg question is that its production is not only being encouraged for the local market, but for the export trade as well. For instance, last year eggs weighing not more than 1¾ oz. were included in the export shipments. These in some cases realized on the London market at least 6d. a dozen less than did the packs containing 2 oz. eggs or slightly over. Notwithstanding this difference in price, under the present crude pool system adopted, the small-egg producer received a return according to count equal to that of the producer of the higher-priced superior article. On the London market New Zealand eggs, as is the case with those from other countries, are sold according to their weight per long hundred

(120). Obviously, if the production of small eggs is to be discouraged, all eggs intended for export should be paid for at this end according to their weight, instead of by the count as in the past. In my opinion no egg should be exported which is not bordering on 2 oz., or, in other words, uniform-sized eggs that will make a minimum pack of 15 lb. per long hundred. The initial shipments that made the good name and built up the high reputation for New Zealand eggs conformed to that standard. I can imagine no shorter cut towards losing that reputation than by shipping undersized eggs. The following extract from a recent trade report received regarding some of last season's shipments will help to bear out this contention: "A number of eggs have been received below the standard grade of 15 lb. per long hundred (10 dozen). The 15 lb. packs and over did fairly well, but the weights below these would show a loss. Unless it is for the purpose of unloading a surplus in New Zealand it would appear as if shippers should make 15 lb., the minimum." The foregoing, together with the fact that all that can be expected of our export trade in the near future is to unload any available small summer surplus for the maintenance of paying local values, is sufficient to indicate that no undersized egg should be exported.

With reference to the 15 lb. pack or over so much desired on the London market, it must not be inferred that this should be made up with eggs of various sizes. It is obvious that the eggs should be graded to be as nearly alike as possible regarding size, for the reason that a uniform pack is easily valued by a prospective buyer, while a mixed line proves troublesome. The great incentive in marketing any high-grade food-commodity is that it commands the high-class trade, which demands the best and is prepared to pay its full market value in return. Especially is the question of quality of paramount importance when catering for an oversea trade in these days of keen competition. It is to be regretted that so many poultry-keepers have bred for numbers of eggs quite irrespective of their size, and rather than endeavour to correct this tendency by careful breeding and selection they urge that an undergrade egg should be exported, meaning, as it will, if continued, the losing of a good name which may prove difficult to regain.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

THE SPRING INSPECTION.

WHENEVER the temperature will allow, advantage may be taken of fine spring days to give the colonies their first inspection of the season. It is highly important that this work should be undertaken early in August, and not postponed until brood-rearing has commenced in earnest. By this time small patches of brood will be found, and under favourable conditions the quantity will rapidly increase, but just in proportion to the amount of food available so will brood-rearing proceed. On no account should the examination be postponed indefinitely if it can be avoided, or in all probability losses will be recorded through starvation. During the dormant season the drain on the stores is small, but once the activities of the hive

commence no effort should be spared to see that each individual colony has sufficient food to meet current demands. Colonies containing at this season 15 lb. to 20 lb. of honey may be left undisturbed for some weeks, but failing this amount preparation should be made for feeding. (See Bulletin No. 55, p. 37, "Spring Feeding of Bees.")

Supers: In order to facilitate brood-rearing, supers left on during the winter months may now be removed and the bees confined to the brood-chamber. In cases where bees are found in the super, remove the deserted brood-combs and place the super containing the bees on the bottom-board. Make all the hives snug, and provide each with one or two extra mats. These will help to conserve the heat of the hive.

Queen-right colonies: As indicated, an important matter in connection with the first examination of colonies is to note the extent of brood-rearing in progress. This will largely determine whether the colony has a laying-queen. Do not hastily conclude that a colony is queenless if brood is not visible, as much depends on the locality and weather conditions preceding the examination. If the colony is strong and normal the question of queenlessness may be postponed until a later date. Make a note of each hive and its condition for future reference.

APIARY RECORDS.

At every examination the beekeeper should make a record of the condition of his hives with regard to stores, brood, health, and fertility of queen. These records are invaluable, and enable one to proceed about his work systematically. Where time and labour are considerations, notes made at the time of inspection will save confusion and endless trouble. A pencil note on the inside of the cover or on a piece of section, and placed under the roof, is handy for reference if by any chance the notebook be mislaid.

PREPARATION FOR THE NEW SEASON.

The beekeeper should, as far as possible, utilize his spare time in making preparation for the coming season. Generally there is a good deal of work which can be undertaken now. Push on with hive and frame making if increase has been decided upon, and with the overhauling of any faulty supers, roofs, and bottom-boards. Usually when the bees are absorbing the greater part of the beekeeper's attention he will find very little time to attend to the mechanical part of the work. Do not postpone ordering supplies. Beekeepers who are not skilled with tools will find it more profitable to purchase their hives from the manufacturers. The machine-made hives can be depended upon, as they have been brought to a high standard of perfection.

When purchasing new supplies aim at uniformity. Do not be tempted to purchase job lines of bee material because dealers have represented the lines to be cheap. Standardize your hives, and endeavour each season as far as possible to dispense with badly fitting supers, &c. Nothing is more tantalizing than to find that supers will not fit the bottom-boards, or that roofs are an inch or so too long. One cannot afford to neglect his working-plant. Good standard hives are among the essentials that lead to profitable management.

FRAME MAKING AND WIRING.

A great deal of time must necessarily be spent performing this very important part of the work. The assembling of brood-frames and extracting-frames should receive every consideration. There are many plans for curtailing the labour involved, but, whatever method is adopted, strict attention must be given to proper nailing. Neglect to secure frames properly will lead to endless worry when the frames are in use. In districts where the bees gather propolis in large quantities too great caution cannot be exercised in nailing. It is not sufficient to drive a nail down through the top bar into the end bar. Too often the top bar will come away and leave the end bars jammed by the pressure of the other frames and adhering propolis. To guard against this trouble, the end bars should be nailed to the top bar by driving two nails through the end bars parallel with and into the top bar. This will secure the frame and prevent it from breaking when in use. On no account dispense with wiring the frames if the combs are to be extracted. Good wiring will enable the beekeeper to handle his combs freely, and even on very hot days there is no risk of their falling from the frames, as is the case when wiring is not adopted. When using full sheets of foundation it is a distinct advantage to employ wire. This holds the foundation in position, and good straight combs are produced. See that the wires are tight and securely fastened. Cut the wire into lengths of about 60 in., and bind in the centre ; the strands can then be pulled out as required.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

WORK among the vegetable crops, detailed in last month's notes, will have been carried out in the warmer districts ; elsewhere the right conditions may now soon be expected, and they should be accepted without delay. Following this, the preparation of land for the main potato and root crops will demand attention, as well as that for tomatoes and the less hardy crops to be planted later. For this purpose land carrying winter and spring crops of cabbage, cauliflower, broccoli, and lettuce will gradually become available, and should be taken in hand right away. Early and good cultivation, and the sprouting and destruction of the weed-seeds in reach of the surface, by way of preparation, will greatly facilitate the growing of those crops.

For the more permanent crops such as rhubarb and asparagus, where new plantings are to be made, a more elaborate preparation is necessary. Heavy dressings of stable and green manure should be made, and in most cases the preparation would be all the better were the subsoil broken up. Where a good deep sandy loam or drained swamp land is available these crops should be planted in larger areas. Established beds of rhubarb should now receive a good dressing of superphosphate and organic manure.

Where kumaras are to be grown, start the tubers now for a supply of rooted shoots.

TOMATOES.

Growers of tomato crops outside will be sowing the seed now; over-rich soil in the seed-box is to be avoided. Make sure of getting a good strain of seed of a variety suitable for your land. Considerable loss and disappointment is experienced annually through omitting this precaution. Crops to be grown under glass are usually planted out towards the end of August. In preparation for this grow sturdy, thrifty plants by giving them plenty of sunshine and air. A big soft plant grown in moisture and heat in a rich soil is not likely to bear the early crop that is the more valuable. Avoid nitrogenous manures at this stage, and see that the land does not lack a sufficiency of lime. Water the plants before setting them out, and spray them with bordeaux if at all necessary. Inspect each plant closely before planting. Discard all that are blind, weak, or untrue to type, and plant in a firm bed.

SMALL-FRUITS.

The planting of gooseberries, currants, raspberries, loganberries, and strawberries should be completed now. Plantations in bearing should receive a dressing of nitrate of soda or sulphate of ammonia as soon as the fruit has set. Prepare the land for Cape gooseberries and passion-vines. Spray strawberry-plants with bordeaux for the prevention of leaf-spot.

TOBACCO-GROWING.

The first tobacco seed-beds are sown down during the month of August; in preparation the soil may now be sterilized by burning. Select a good free loam, well drained and in a warm locality. After sowing, protect the beds from frost and drying-out by shading with a hessian cover. At the same time proceed with the preparation of the land for planting out the crop. It should be deep and thorough. A dressing of 4 cwt. or 5 cwt. of lime would suit most soils, and, if at all sour, it can be increased to ½ ton or more with advantage. Destroy the weeds in fine weather as they germinate; it is easier done now than later when the crop is planted out.

GARDEN PESTS.

The depredations of wood-lice, slugs, snails, wireworms, and cut-worms are the cause of considerable inquiry at this season. Until more effectual natural enemies are found the war will have to be waged from year to year by other means.

For the destruction of slugs and snails, fresh air-slaked lime is a powerful agent. Apply it after sunset or before sunrise when the pests are feeding. Cheap and convenient mechanical dusters of new design are now available. They are quick and effective, and dispose of all the unpleasantness experienced when one has to broadcast the lime. It is well to remember that bluestone is also effective in this connection. Applied to plants as a Bordeaux or Burgundy mixture it might well suit a twofold purpose. Nitrate of soda is another remedy, and applied to a crop of lettuce, cabbage, or cauliflower in early spring it will serve a twofold purpose of another kind. The lime and nitrate are also useful in countering the attack of wireworms.

Wood-lice are readily destroyed when secreted in their daytime resorts by the old-fashioned method of applying hot water, but quite often they cannot be reached in this way. The Cheshunt Research

Station publish the following remedy, which should have a wider usefulness: Oatmeal, 50 parts; potassium bichromate, 1; glucose, 2; and water, 30 parts. The potassium should be dissolved in water before adding it to the other ingredients.

For both cutworms and wood-lice the following recipe is worth a trial: Paris green, ¼ lb.; bran or pollard, 1 peck; molasses, 1 pint; water, 4 to 6 quarts. Mix the two dry ingredients thoroughly, and in another vessel the molasses and water. Add the liquid to the first mixture slowly, stir, and allow to stand for several hours. Scatter thinly between the rows of plants after sunset. It would be interesting also to try powdered arsenate of lead, which is more generally available, in the place of Paris green.

PLANTING OF TREES AND SHRUBS.

We are now getting toward the end of the season for planting out trees and shrubs. Where such work has to be done it should now take precedence over all other work in fine weather.

—*W. C. Hyde, Horticulturist.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 7th May to 2nd July, 1925, include the following of agricultural interest:—

No. 51926: Milk-sediment tester; E. C. Alexander, Wellington. No. 52348: Seed-hulling apparatus; F. S. Hill, Cobden, Victoria. No. 53295: Poison-gas generator for rabbit-destruction; C. A. Mulholland, Northwood, N.S.W. No. 53681: Concrete-post mould; E. Andersen, Midhirst. Nos. 52069 and 52070: Cheese-crate-head-cutting machine, and forming; G. Osborne, Mataura. No. 53748: Cream-separator; D. Cuthbert, Birkenhead. No. 51745: Milking-machine teat-cup; C. F. Claasen, Rawene. No. 52087: Milk and cream pasteurizer temperature-control; L. Hansen, Christchurch. No. 52237: Milking-machine teat-cup-cleansing device; T. Shiels, Invercargill. No. 53419: Plant-growth enhancing; C. F. Eckhart, Honolulu, Hawaii. No. 52369: Milk-strainer; E. A. Amos, Matamata. No. 53393: Brooder; A. J. H. Beduhn, Prenzlau, Queensland. No. 53407: Cream-testing process; Pfandler Company, Rochester, U.S.A. No. 53824: Animal-leg rope; E. F. Murphy, Ngaruawahia. No. 53836: Grain- and seed-sorting machine; Douglas and Grant, Ltd., Kirkcaldy, Scotland. No. 53881: Insect-pests destruction; A. M. Kobiolke, Gilderoy, Victoria. No. 52821: Chicken-brooder; S. D. Rogers, Upper Hutt. No. 53703: Wire-fencing dropper; G. E. Cluett, Auckland. No. 53815: Wire-strainer; T. Crawford, Walsall, England. No. 53957: Milking-machine teat-cup support; T. B. Crawshaw, jun., Christchurch. No. 54040: Crop-drying in stack; B. J. Owen, Institute of Agricultural Engineering, Oxford, England. No. 54161: Cheese-press hoop; Wilkins Ltd., Invercargill.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price, 1s.

Instructional Services of Agriculture Department.—The Governor-General's speech at the opening of Parliament last month contained the following passage: "My Ministers realize that the development of our primary industries demands an extension of the instructional services of the Department of Agriculture. It is proposed to increase the trained staff of the Department in order that information and advice may be provided directly to producers through the medium of trained instructors stationed at various suitable centres throughout the Dominion. The existing services of the Department have already been the means of rendering material aid to producers, and provide a basis upon which a wider and more comprehensive service can be established."

WEATHER RECORDS: JUNE, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

The weather of the month of June was dominated by conditions similar to those of May. There was again a remarkable prevalence of ex-tropical disturbances, chiefly affecting the North Island and north-eastern districts of the South. Under these circumstances the western and southern districts of the South Island had, on the whole, more pleasant winter weather than other parts of the Dominion.

The month opened with stormy weather and high south-easterly winds, and unsettled conditions continued, especially in the North, until the 13th, when a severe disturbance passed to the eastward, bringing cold and heavy southerly weather along the east coast. Both the front and rear of a disturbance ruling from the 23rd to the 26th accounted for some heavy rains and high winds. The month closed with trying easterly winds and heavy rains in the northern and east-coast districts. There was also considerable snow in the South.

Returns so far to hand show that rainfall was below the average in South Canterbury, Westland, and Otago, but greatly in excess in most parts of the North Island, and on the higher levels of Canterbury and in Christchurch City.

Barometric pressure was highest between the 11th and 22nd, when many parts experienced fine weather by day and cold and frosty nights. Frosts appear to have been more numerous and severe than are commonly experienced in June.

There were three hard southerlies on the east coast. Some parts of the country reported less wind than usual, but this does not appear to have been the general experience.

—*D. C. Bates, Director.*

RAINFALL FOR JUNE, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	7·80	20	1·23	5·53
Russell	13·36	22	6·60	6·28
Whangarei	13·12	23	3·30	5·26
Auckland	7·85	21	1·86	4·79
Hamilton	8·17	17	2·02	5·07
Kawhia	8·01	16	1·94	5·46
New Plymouth	6·64	17	1·38	6·21
Riversdale, Inglewood	12·16	21	2·56	10·31
Whangamomona	6·65	13	1·62	7·92
Tairua, Thames	11·18	16	3·16	6·95
Tauranga	15·01	15	6·02	5·05
Maraehako Station, Opotiki	7·30	14	1·56	5·68
Gisborne	9·69	25	1·81	5·21
Taupo	10·54	13	2·30	4·35
Napier	6·57	23	1·11	2·45
Maraekakaho Station, Hastings	8·92	23	1·31	3·33
Taihape	4·46	21	0·60	3·79
Masterton	7·39	22	1·41	3·41
Patea	5·05	20	0·91	4·40
Wanganui	2·20	8	0·58	3·29
Foxton	3·28	11	0·72	2·83
Wellington	8·33	21	1·13	4·85
South Island.				
Westport	2·69	13	0·64	7·53
Greymouth	4·62	11	1·46	8·99
Hokitika	6·07	13	2·42	9·72
Arthur's Pass	12·59	7	4·53	9·77
Okuru, Westland	4·82	6	1·42	10·76

RAINFALL FOR JUNE, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Collingwood	10·58	12	3·92	11·33
Nelson	3·68	11	1·35	3·75
Spring Creek, Blenheim	4·97	12	1·35	3·23
Tophouse	3·97	11	0·97	4·99
Hanmer Springs	8·21	15	1·75	2·83
Highfield, Waiau	6·06	15	1·00	2·50
Gore Bay	6·34	16	1·80	2·30
Christchurch	4·32	21	0·63	2·64
Timaru	1·32	12	0·40	1·84
Lambrook Station, Fairlie	..	..	..	2·06
Benmore Station, Omarama	1·03	7	0·30	2·06
Oamaru	1·52	11	0·35	2·11
Queenstown	1·13	4	0·62	2·41
Clyde	0·34	3	0·20	0·98
Dunedin	2·97	14	0·55	3·13
Gore	1·50	14	0·32	2·76
Invercargill	2·03	12	0·48	3·54

PARCHMENT PAPER FOR EXPORT BUTTER.

REPORTS from various sources in Britain, including the Department's Inspector of Dairy-produce in London, were received on several occasions during the past season commenting unfavourably on some of the parchment paper used in the packing of New Zealand butter. In a number of instances the paper was found to be brittle, and broke into pieces when being removed from the butter. In other cases the paper was thin and did not afford the butter the amount of protection from the odour of the timber of the boxes which thicker paper would have done, and this was particularly noticeable with butters which had been held in cold storage for prolonged periods. To obviate these defects it is recommended that only the best-quality parchment paper, of a weight of not less than 28 lb. to 30 lb. per ream, be used, and, as is customary, of two thicknesses. If paper of lighter weight is used the wrapping should consist of three thicknesses.

BOOKS RECEIVED.

"THE CULTURE OF LUCERNE," by W. S. Hill, B.Agr. (N.Z.), Instructor in Agriculture, Seddon Memorial Technical College, Auckland; 268 pages; illustrated; price, 6s. 6d.; Whitcombe and Tombs, Ltd., Wellington, &c. Lately issued volume of the "New Zealand Practical Handbooks" series.

"ANIMAL GENETICS: AN INTRODUCTION TO THE SCIENCE OF ANIMAL BREEDING," by F. A. E. Crew, D.Sc., &c., Lecturer in Genetics in the University of Edinburgh, and Director of the Animal Breeding Research Department; 420 pages; illustrated; price, 15s. net; Oliver and Boyd, Edinburgh and London.

"THE PIG BREEDERS' ANNUAL," 1925; 152 pages; illustrated; price, 2s. 6d.; published by the National Pig Breeders' Association (England), 92 Gower Street, London.

"NEW ZEALAND TO-DAY." An accredited illustrated description of the Dominion's industries, commerce, resources, scenery, sport, &c., produced by Vivian E. Page, Dunedin (publisher of "Progressive New Zealand," 1924), and edited by L. S. Fanning. New Zealand and South Seas International Exhibition (Dunedin) edition.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

ABORTION IN COWS.

A. K., South Makirikiri :—

Would you kindly explain the difference, if any, between contagious abortion in cows and cows slipping their calves?

The Live-stock Division :—

"Contagious abortion" indicates a specific disease of cattle caused by a germ termed *Bacillus abortus.* "Slipping calves" indicates no more than a premature birth or a sporadic abortion from any cause whatsoever, but the term is generally used to refer to contagious abortion. In contagious abortion a series of abortions occur one after another in the affected herd. The abortion typically occurs about the sixth or seventh month, but may take place at any stage of gestation from service to parturition. In sporadic abortion one finds a single isolated case of a cow slipping her calf—at any period of gestation—from some accidental cause, such as injury, overdriving, lymphany, &c. In contagious abortion the placenta ("cleansing") is often retained for several days, and the cotyledons ("roses") have a characteristic yellowish-brown rotten appearance; also there is a considerable discharge of thick chocolate-coloured material from the vagina. In the sporadic type the placenta is healthy-looking and normal in appearance, and characteristically comes away at the time of or shortly after the act of abortion. As regards treatment after a sporadic abortion, all that is necessary is to syringe out the genital passage with a mild antiseptic solution—for example, perchloride of mercury, 1 part; water, 3,000 parts. The treatment of contagious abortion is dealt with in the Department's Bulletin 93, "Abortion Disease in Dairy Herds," a copy of which has been sent to you.

CONTROL OF GRAIN-WEAVILS.

J. V. Wyatt, Leigh :—

Please advise the best way to get rid of grain-weavils. My shed has been badly infested for several years, and the weavils seem to increase rapidly in loose oaten chaff.

The Fields Division :—

The control of grain-weavils can be carried out satisfactorily and economically only where an airtight fumigating-chamber is available, and any one regularly storing quantities of grain or chaff should have such an appliance as part of the store. The size of such a chamber would vary according to the amount of material handled, though a great deal can be treated by several fumigations in a comparatively small chamber. An effective chamber can be constructed of wood, with the outside walls of storm-boarding, and the inner walls and floor of tongued-and-grooved timber, which also covers the roof, the latter being overlaid with ruberoid. The whole inside finally is enamelled. The door must be quite airtight when closed, and it is advisable to have an opening closed by an airtight door on the back and side walls for ventilating purposes after fumigation. Both doors and ventilators should open outwards. The chamber should be raised on piles off the ground. Considerable quantities of material could be treated in a chamber of 1,000 cub. ft. air-space. The safest fumigant to use is carbon bisulphide, and in an airtight chamber such as described 5 lb. of bisulphide to 1,000 cub. ft. of air-space would be effective. The length of time required for fumigation varies with the temperature, and the best results are secured at a temperature of 70° F. or over, the chamber being kept closed for twenty-four hours. The lower the temperature, however, the less readily does the bisulphide volatilize, and the time required becomes longer. Where a comparatively small quantity of material is to be fumigated it can be placed in a barrel, 1 oz. bisulphide to every

100 lb. of material poured on to the material, and the mouth of the barrel tightly closed for forty-eight hours. If more than one barrel is used a considerable quantity of material can be so treated. The carbon-bisulphide fumes are heavy, and the fumigant should be placed in shallow vessels (benzine-tins cut down) high up in the chamber. As this fumigant is inflammable no lights of any sort whatsoever should be in the vicinity during fumigation.

CHAFF AND MANGOLD RATION FOR BREEDING-EWES.

J. Cox, Eiffelton :—

I am feeding breeding-ewes with cocksfoot-straw chaff—five sacks to 4 bushels Algerian oats—with mangolds. Could you advise me in what proportion to feed same to obtain best results ?

The Live-stock Division :—

In determining the proportions of the ingredients mentioned by you, consideration must be given to the condition of the sheep and the conditions under which they are living before a definite ration can be laid down. For sheep living under average conditions the quantity necessary is between 3 and 4 tons of mangolds and 600 lb. to 1,000 lb. of chaff mixture per week for each hundred sheep. If the weather continues to be wet and cold it would be advisable to give the sheep as much chaff mixture as they will eat, and supply mangolds in the proportion stated. This diet is deficient in protein for anything but holding sheep, but it will suit ewes in lamb quite well. From 30 lb. to 40 lb. of whole or split peas to the diet as the ewes get near lambing would be an improvement. The ewes should also be given plenty of exercise. The proportion in which you are mixing the cocksfoot chaff and Algerian oats is quite suitable.

MANURING BLACK CURRANTS.

"INQUIRER," Havelock North :—

I propose manuring about ¾ acre of black currants on heavy soil. Would you please advise me when is the best time to do it ; also the best manure to use, and how much ?

The Horticulture Division :—

For manuring your black currants you are recommended to try a mixture of 3 cwt. superphosphate and 1½ cwt. sulphate of potash, applying it towards the end of July. When the fruit has set apply 1½ cwt. nitrate of soda.

CLEARING AND GRASSING MANUKA HILL COUNTRY.

"MANUKA," Uruti :—

I have just had cut a considerable amount of manuka, both big and small. It was growing in some gullies and on easy faces, lying fairly well to the morning sun but a bit shady in the afternoon. The country is mostly blue papa. In most places under the manuka there is a growth of hard fern. I would like to have advice as to when to burn, and what would be the most useful mixture of grass-seeds to put on the burns.

The Fields Division :—

As you have the scrub cut it will be advisable to get a burn in the spring, for if left until autumn the seeding manuka will probably nullify your chances of a good burn. When the fallen manuka will be ready must, of course, be dependent upon the weather, but it should be fit to take a good fire by August. Failing this you will have to let it wait until the autumn and chance a good burn. The grass-seed should be sown as soon as possible after the fire has died out, so as to make the best of the ash seed-bed. A suitable mixture would be as follows: Cocksfoot, 3 lb ; crested dogstail, 3 lb. ; perennial rye-grass, 8 lb. ; brown-top, 2 lb. ; Danthonia pilosa, 3 lb. ; Lotus major, 1 lb. ; white clover, 1 lb. ; subterranean clover, ¼ lb.

CONCENTRATES FOR DAIRY COWS.

C. N. RUSSELL, Matamau :—

Kindly let me know if there is any great benefit derived from feeding concentrates, such as bran, linseed, nuts, &c., to the average dairy herd during the milking season, and, if so, the necessary amount to give.

The Live-stock Division :—

During the season when green feed is normally plentiful, and provided shelter is available, such concentrated foods should be unnecessary. During the later part of the milking-period, however, and particularly in the case of heavy milkers, a supplementary ration may be given with advantage with the view of replacing the salts lost during the season, and giving the cows a start for the next lactation. Amounts of 2 lb. bran and 2 lb. nuts or linseed-meal would be a suitable addition to the feed, and a handful of salt might be added with advantage.

GROWING OF EARLY LETTUCE.

O. E. CLARK, Christchurch :—

I would like advice regarding the growing of hothouse lettuce for early market. Would you kindly inform me as to treatment of the soil, manuring the crop, and dealing with any diseases?

The Horticulture Division :—

In the warmer parts of the country lettuce is readily grown outside all the year round. However, should your land be exposed to cold weather, a cold frame or unheated glasshouse would best suit the purpose. The soil should be well manured and deeply cultivated, using well-decayed stable manure and about 3 cwt. superphosphate per acre. When the plants have commenced to make growth apply a dressing of nitrate of soda. Slugs often trouble the young plants in spring. A remedy is to dust the plants with slaked lime during the evening or early morning.

PREVENTION OF EARLY BLIGHT IN POTATOES.

C. H. B., Pukekohe :—

Could you inform me as to the best method of preventing rust appearing in potato crops? The haulms die down in patches a month or six weeks before maturity. The tubers are undersized, but not otherwise affected. Would a dressing of sulphate of iron be beneficial, and would basic slag have the same effect as sulphate of iron?

The Fields Division :—

The Department's Mycologist suggests that the disease referred to as "rust" was probably that known as early blight. As a means of prevention, anything you may do in the way of better cultivation, better drainage, and better feeding of the crop will bring about increased vitality, and therefore make it more resistant to the attack of fungous diseases. Sulphate of iron is sometimes used for the control of diseases in potato crops. A dressing of ground sulphate, which is a green salt, is applied to the soil about a week before sowing the crop. It can be applied in a similar manner to the ordinary fertilizer, but it is desirable to apply them separately, especially if superphosphate is in the potato manurial mixture. Use the sulphate of iron at the rate of 1 cwt. per acre. Sulphate of iron is regarded as a fungicide, and probably its value is due to this fact. Basic slag would certainly not have the same effect as sulphate of iron. It would, however, supply phosphate, and would help in increasing the vigour and yield of the crop. Regarding the potato manurial mixture the following is advised: Superphosphate, 5 parts; bonedust, 3 parts; sulphate of potash, 2 parts. Use 6 cwt. to 10 cwt. of the mixture per acre. Even up to 16 cwt. and 20 cwt. per acre may be used with profit, especially for the early potato crop.

UNIFORMITY IN GRADING OF BUTTER AND CHEESE.

THE necessity for uniformity in the grading of butter and cheese at the various grading-ports has been recognized since the inception of that service by the Department of Agriculture. Up to the present many factors have contributed to uniformity in this work, among which may be indicated—

(1.) The fact that when Graders are appointed they are selected from a class of efficient, successful factory-managers, already conversant with the standards used in grading butter and cheese.

(2.) The training of new appointees while working in the capacity of assistant graders.

(3.) Conferences of Graders at selected grading-ports.

(4.) The assembling of Graders and Instructors from various districts in connection with the work of judging the large exhibits of butter and cheese at the various winter shows.

(5.) Visits to the several grading-ports, as time permits, during the season, by the Assistant Director or Director of the Dairy Division.

These factors have been instrumental in maintaining a very satisfactory degree of uniformity in the past. The general expansion of the work under the control of the Dairy Division is, however, making it increasingly difficult for the Assistant Director and Director to visit grading-ports as often as desirable. In view, therefore, of the necessity of maintaining the greatest uniformity possible, it has been arranged that during the ensuing season Mr. J. O'Dea, Grader in charge, Wellington, will, at intervals, visit North Island grading-ports; and that Mr. Clayton, Grader in charge at Lyttelton, will pay similar visits to South Island ports. The fact that these officers will be working in the capacity of supervising Graders should give even greater assurance to dairy companies and factory-managers that the grading will be kept uniform throughout the grading-ports.

—W. M. Singleton, Director of the Dairy Division.

IMPORTATION OF PEDIGREE STOCK INTO GREAT BRITAIN.

A MOVEMENT was initiated some time ago to obtain such relaxation of the British regulations as would enable the importation, under reasonable safeguards, of pedigree stock into Great Britain from British overseas countries. The matter was discussed at the last Imperial Conference, and certain provisions in this respect were agreed to. A Bill on the lines of this agreement was subsequently introduced into the Imperial Parliament " to amend the law with respect to the landing in Great Britain of pedigree animals brought from His Majesty's dominions." The stock specified were cattle, sheep, goats, and swine. Official advice was received last month that the Bill as introduced had been passed without modification, except the addition of a provision requiring consultation with the Royal Agricultural Society of England and Ireland, and the Agricultural Society of Scotland, before a Ministerial order is made allowing the landing of any stock covered by the measure. The " Importation of Pedigree Animals Act, 1925," as the measure is entitled, enables the landing of stock under such conditions as will make exportations from New Zealand to Great Britain practicable. Intending shippers should, of course, make themselves familiar with the conditions and other details of the Act. Pending the receipt of copies of the latter, the original Bill may be seen by any person concerned at the Head Office of the Agriculture Department, Wellington.

Tree-planting.—During the year 1924–25 a total of 2,930,564 young trees was disposed of by the State Forest Service to farmer-settlers, local bodies, and proprietary companies, as compared with 1,839,512 in the preceding year.

DAIRY FACTORIES IN NEW ZEALAND, 1925.

THE following table presents the registrations of factories under the Dairy Industry Act as at 30th April last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1925, and the numbers of milk or cream suppliers to the factories :—

District.	Number of Factories.				Forwarded for Export, 1924–25.		Number of Suppliers to Factories.	
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese and Dual Plant.
					Tons.	Tons.		
Auckland ..	65	32	5	102	41,062	9,370	16,612	913
Taranaki ..	19	71	38	128	9,388	32,970	2,982	3,398
Wellington ..	17	50	12	79	8,858	12,418	4,574	1,729
Hawke's Bay ..	11	15	4	30	3,786	3,568	3,687	690
Nelson	5	4	1	10	1,164	441	939	485
Marlborough ..	4	4	3	11	789	821	660	304
Westland ..	10	..	1	11	675	100	904	32
Canterbury ..	10	13	4	27	2,787	1,616	5,997	1,526
Otago and Southland	15	78	1	94	2,554	10,712	6,968	2,724
Totals, 1925 ..	156	267	69	492	71,063	72,016	43,323	11,801
Totals, 1924 ..	156	295	64	515	57,818	71,255	41,704	12,296

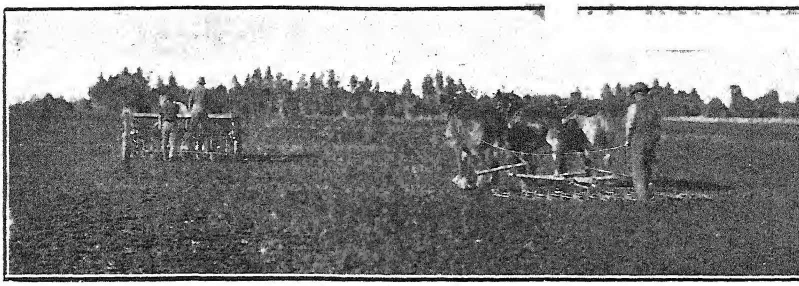
In the 1924–25 period there were also operating in the Dominion five milk-powder factories (two whole-milk and three skim-milk plants), five casein-factories, one condensed-milk factory, and one sugar-of-milk factory.

VARIETIES OF APPLES EXPORTED IN 1925 SEASON.

THE following particulars of the varieties of apples exported from New Zealand to Britain, South America, Hawaii, and British Columbia in the 1925 season have been compiled from Orchard Instructors' reports, the figures representing the number of 1-bushel cases shipped :—

Sturmer, 68,092 ; Jonathan, 59,011 ; Delicious, 21,954 ; Dunn's, 18,131 ; Dougherty, 14,802 ; Cox's Orange, 7,932 ; Statesman, 7,776 ; Rome Beauty, 5,657 ; London Pippin, 4,874 ; Scarlet Nonpareil, 3,111 ; Cleopatra, 2,588 ; Newtown Pippin, 2,417 ; Rokewood, 2,050 ; Premier, 1,798 ; Worcester Pearmain, 1,660 ; King David, 1,455 ; Lord Wolseley, 1,416 ; Adams Pearmain, 1,290 ; Pioneer, 780 ; Tasma, 616 ; Spitzenberg, 587 ; Hoover, 581 ; Stark, 374 ; Washington, 320 ; Frimley Beauty, 295 ; Shoreland Queen, 292 ; Ballarat, 292 ; Edward Lippiatt 250 ; Yates, 230 ; Salome, 222 ; Rona, 218 ; Stayman, 211 ; Scarlet Pearmain, 194 ; Willie Sharp, 155 ; Crofton, 150 ; Tasma's Pride, 150 ; Brownlee's Russet, 140 ; Ribston Pippin, 125 ; Brighton, 110 ; Granny Smith, 96 ; Beaumann's Reinette, 86 ; Rymer, 73 ; Shepherd's Perfection, 73 ; Boston Russet, 47 ; Senator, 32 ; Allington Pippin, 20 ; McMahon's White, 19 ; Commerce, 6 ; Kentucky Redstreak, 3 : total, 232,761.

London Market for Peas and Beans.—The following advice was cabled by the High Commissioner on 4th July : *Peas*—Maple partridge, very little demand for spot or for shipments ; New Zealand ex store offered at 67s. 6d. to 72s. 6d. ; Tasmanian, 75s. to 82s 6d. ; No. 1 New Zealand, sale reported at 68s. c.i.f. ; " A " Tasmanian quoted at 70s. to 73s. 6d. c.i.f. Blue, fair demand for Japanese and Dutch continues. Japanese green have been sold at £22 15s. per ton, May or June shipments. English crop yield expected to be light on account of dry weather. *Beans*—Very little business has been done. English spring offered up to 54s., winter 48s. New crop Chinese horse, July–September shipments, offered £10 7s. 6d. without finding buyers.



The New Zealand

Journal of Agriculture.

Vol. XXXI.—No. 2.

WELLINGTON, 20th AUGUST, 1925.

GENITAL DISEASES OF CATTLE.*

TEMPORARY STERILITY AND CONTAGIOUS ABORTION.

C. S. M. Hopkirk, B.Sc. (Melb.), Acting Officer in Charge, Veterinary Laboratory, Wallaceville.

The Department of Agriculture is particularly anxious to find practical means of helping dairy-farmers to combat genital troubles in cattle, and towards that end several of its Veterinarians—Mr. T. A. Blake, at Masterton, Mr. D. A. Gill, at Palmerston North, and Mr. A. McKenzie, at Hamilton, together with Mr. W. M. Webster, engaged in supervising meat-inspection at Wellington—are collaborating with the Wallaceville Laboratory in special investigation work. Researchers have been engaged for thirty years or so in other countries on similar work, and are no further advanced in arriving at the solution than we are. The difficulty of the work in hand may thus to some extent be realized.

TEMPORARY STERILITY AND GRANULAR VAGINITIS.

In order to grasp the theory for temporary sterility here put forward it is necessary to understand the physiology of the œstral cycle—that is, a period or a "bulling" of the cow. In a healthy œstrum the ovary produces an egg which is dropped into the fine tubule,

* Substance of an address to the Annual Dominion Conference of the New Zealand Farmers' Union, Wellington, July, 1925.

down which it proceeds to the horn of the womb. During this passage it is fertilized by the male sperm, and so is able to commence growth and become attached to the wall of the uterus. Should the cow not be served the egg passes out, in a mild menstruation often, and the cow does not show heat for another twenty-one or twenty-two days. When the egg is first passed from the ovary a blood-clot forms in the hollow left by the burst bladder in which the egg is formed, and this blood-clot later becomes a brown to yellow or orange body of the size of an acorn, half buried in the ovary and showing a projecting knob on the surface. While this "lutein" body, as it is called, remains in a normal state and does *not* degenerate the cow will *not* show heat, and when the cow conceives this body remains in place for thirty to sixty days after the birth of the calf. If the cow does not conceive, the lutein body degenerates sufficiently in eighteen days for a heat period to occur in from twenty-one to twenty-two days from the last period.

Some cows which do not return to the bull at all after calving, either normally or abnormally, are found to have this lutein body retained in the ovary—permanent sterility resulting; but if it can be expressed by hand the cow will take the bull in three days. Personally I have been able to express this body in three cows during the past season with satisfactory results, and my colleagues all have like experiences to relate.

Passing on to the condition of granular vaginitis, this can be described, in its simple state, as a granular eruption of the mucous surface of the vulva, just within the lips and extending rarely more than 3 in. to 4 in. forward. These granules become very red and inflamed, and are inclined to bleed during the act of copulation; also they become much more noticeable and sore at about the period of œstrum. Even though this inflammatory condition is so easily seen, the farmer is usually quite unaware of its presence unless there is at the same time a pronounced discharge, either from a further bacterial infection of a secondary nature or from disease of the mouth of the womb.

Granular vaginitis is so prevalent that one almost mistakes the appearance of the mild form of the disease for the normal condition of the vulva. It is known in all countries, but is not looked upon with very great concern. In New Zealand we have been associating it with the return of cows to the bull, a condition which has lately been very prevalent—a temporary sterility with which the cow finally takes the bull anywhere up to the end of summer—say, February. It is thought by some farmers that this is in some way connected with the hot weather. During last milking season a number of herds were examined and records taken to try and arrive at some conclusion as to the fundamental reason for this temporary sterility; and, while we (the investigators) are not prepared yet to say that granular vaginitis in its most severe stage is not a factor in causing temporary sterility, the mass of evidence certainly pointed to this disease not being the usual cause. While, on the one hand, cases are known where cows affected with vaginitis in its acute form have failed to hold to the bull, we have, on the other hand, met with experiences where the cow most severely affected was the first to hold to the bull, while cows which were considered so mildly affected as to be about normal refused to hold, and, what is more, returned at irregular

intervals. Looking more deeply into the question, one finds, with the aid of suitable instruments, that the mouth of the womb is often very much inflamed, and we believe that this is a much greater factor in temporary sterility than is vaginitis.

We believe—and laboratory and field work is in progress to prove or disprove the supposition—that infection passes from the mouth of

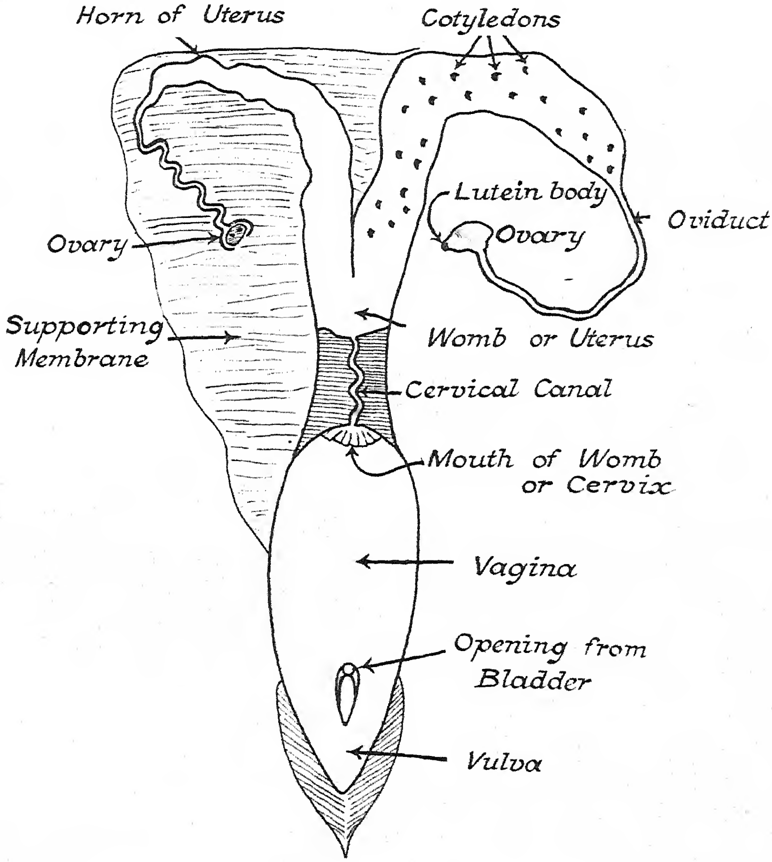


DIAGRAM OF GENITAL ORGANS OF COW.

the womb to the small oviducts and thence to the ovaries, the organisms responsible setting up a disease of the lutein bodies which causes them to become cystic. (Specimens shown.) While the property known as lutein is present in a certain quantity in the ovary, periods, which in the cow occur about every twenty-second day, are inhibited. If this material breaks down sufficiently in nine days, as is often the case when cysts are present, then one gets the cow returning to the bull in nine days; if two months is the time taken, then the cow remains

free from periods for that length of time and gives the impression that she is in calf. In all probability the egg from the ovary was killed by bacteria, either as it left the ovary or in the oviduct, and so could not be fertilized.

We are more than ever in favour of this theory of the breaking-down of the lutein bodies and premature death of the egg causing temporary sterility since specimens were collected in a recent cull-cow drive in the Wairarapa district. On this occasion Mr. Blake was able to trace histories of a number of the cows affected, and in the works to find that the ovaries of cows which repeatedly returned to the bull contained varying numbers of these cystic lutein bodies. Pregnant cows rarely show a cystic degeneration of the lutein body. Of course, other factors may prevent the ovum from being fertilized. One is the possibility of a plug of mucous forming in the mouth of the womb during inflammation of that area, thus mechanically preventing conception. Another factor is the acidity set up by inflammation in an organ which is usually neutral or alkaline; acids are particularly harmful to the male sperm, and may prevent conception by causing death of the sperm.

Discharge from the mouth of the womb has been examined many times at the Wallaceville Laboratory, and shows in a large percentage of cases just two micro-organisms. These two, although present normally, somehow or other appear to have obtained greater power to damage the body-tissues than they previously possessed. It may be that with increased discharge from an inflamed cervix the wall of the vagina is made sodden, and that organisms flourish there at the expense of the vaginal wall. Possibly the original cervicitis—that is, inflammation of the mouth of the womb—is carried by the bull from one cow to another, and where this condition is rife the bull should be washed out after serving each cow.

It must be realized that cows kept under ordinary dairying-conditions cannot be expected to possess the same degree of natural resistant power to the invasion of disease germs which is possessed by cows living and breeding under natural conditions, such as exist, for instance, upon station properties where beef-producing herds are kept. There the cows breed and rear their calves naturally; they have a wide range of pasture, and their milk-producing capacity is not extended beyond the limits required for the rearing of their progeny. On the other hand, the dairy cow fulfils her natural milk-producing function under less natural conditions; she has been developed into a milk-producer more or less in excess of what nature intended her to be, and she has to graze over a comparatively limited area of land which has been closely stocked with dairy cows, and perhaps contaminated by various diseases from which these cows have suffered for varying periods of years. Moreover, as a calf, in far too many instances she has been weakened in constitution by being reared artificially, often on inadequate food, instead of naturally upon good whole milk, as Nature intended her to be. All these conditions tend to lower the natural capacity of the dairy cow to resist the invasion of disease, and render it necessary for the dairy-farmer to observe in every way the principles of cleanliness, and to do all that is reasonably possible to maintain the bodily health and vitality of his cows by good feeding and good management generally.

It is, of course, recognized that economic conditions necessitate the farmer keeping as many cows as his farm is capable of carrying, and getting as much milk from them as he can; but it must never be forgotten that this entails the reducing of the disease-resistant powers of the cows. Moreover, the development of the milking-faculty of the cow beyond what Nature intended it to be is calculated to interfere with the normal operation of the generative organs, with which the udder is closely associated through the medium of the nervous system. Thus it is not difficult to understand why mammitis, failure of conception, abortion, or other troubles associated with the genital system are so common and so troublesome among dairy cattle and so rarely met with among station cows.

Following out this line of thought we are testing on several farms the usefulness of feeding phosphates to dairy cows. In the coming season we should like to try feeding of a more helpful nature with concentrated foods, in order to find just how far the system of a healthy cow can be built up to enable her to resist the infection. The great difficulty is to find suitable herds upon which to work. Again, it must be remembered that the dairy cow is not a normal animal, in that the milking-factor has been developed to such an extent that in heavy-milking breeds sterility is believed often to result; certainly fertility is interfered with. How far this has to do with our present trouble I am not prepared to say.

During the past year numbers of drugs have been tried for douching and drenching cows, but none has been used which has effected a cure for sterility. A mild disinfectant, however, is helpful towards overcoming the inflammation of the vagina, and possibly helpful in overcoming inflammation of the mouth of the womb; but the continuous use of an irritating fluid, often introduced in a dirty manner, greatly reduces the milk-production of the animal—merely from restlessness and fear, if from no other reason.

Although we do not place much credence on granular vaginitis being at the root of temporary sterility, we do believe that granular vaginitis is a communicable disease carried both by the bull and by other means. In Europe one bacteriologist has isolated a particular organism which he associates with this disease, but, as far as I am aware, nowhere else has this organism ever been isolated. Certainly I have not found it in repeated attempts at our own Laboratory, nor have I isolated any organism which will set up the disease in apparently healthy cattle. I use the term "apparently healthy" advisedly, as one often finds calves and heifers which have not been put to the bull affected with vaginitis. One American authority puts the blame for this on giving unboiled milk to calves, but such has not been borne out by our own experiments with a limited number of calves.

CONTAGIOUS ABORTION.

The second disease which I will deal with is contagious abortion. Unlike granular vaginitis, contagious abortion in New Zealand is directly caused by the ravages of a known bacillus. It is argued in some countries that this bacillus is not the chief one responsible for the slipping of calves, but, judging by cases of abortion investigated at Wallaceville, I have no hesitation in saying that in New Zealand it

certainly is the one. The disease of abortion has been known in cattle since ancient times, but the identification of the organism did not take place till 1896, when Professor Bang, of Copenhagen, demonstrated its presence in a number of experiments. Dr. Gilruth noted the disease in New Zealand in a contagious form in 1895, and since that date infection of cattle has gone steadily ahead. Possibly some general action by farmers at that time might have prevented the trouble we have now; but if New Zealand were clean in this respect (and wished to remain clean) it would be difficult for us to bring pedigree cattle from other parts of the world, as most countries are in no better condition than our own.

The chief symptom of the disease is the abortion of a dead fœtus of any period. Other symptoms, which may not be recognized as such, are retention of the afterbirth beyond the normal time, and the birth of dead calves. Sometimes, too, calves are born in a weakly condition and with an inclination to scour, but I do not believe that the white scour so common in America, and considered to be due to contagious abortion, occurs in New Zealand. I can, however, get no definite information on the point beyond the fact that it has not been noted by the Department of Agriculture.

The seat of infection in cattle is a matter for consideration. Primarily the womb is affected, and from there the membranes of the fœtus, an attack being made finally where the membranes attach to the walls of the uterus of the mother. The fœtus dies, and at death the womb, in the majority of instances, makes attempts to void the dead body, usually successfully. Round the membranes is a yellowish to brownish deposit, not in any way evil-smelling, and it is in this deposit that one finds crowds of the organism of the disease. Until the walls of the womb of the cow heal there will be a discharge through the vulva of the cow, dirtying the tail, and also falling upon and contaminating the paddocks. Once the womb has healed it will be found in the majority of cases that infection has passed into the udder, but whether this is through the blood-stream or up the teat-duct is a matter at present under discussion by scientific workers. It suffices for our purposes to say that the disease will lurk in the udder until the cow again becomes pregnant. This organism is harmless to the human race, though one very similar in all tests causes a disease called Malta fever.

Knowing where the organism is found, one may then consider how infection is spread. Chief of these means is the infection of paddocks both from dropping of uterine discharges and from excreta of calves feeding on milk from an infected herd. The cow picks up the contaminated fodder and so takes the germ into the system, where, if the animal is pregnant, it finds its way to the uterus. Should the cow not be pregnant it seems, by experiments conducted in several countries, that the organism may arrive at the udder and remain there until pregnancy, but this is not a point which need be given consideration here, except to mention that it is an argument against wholesale vaccination.

A method of infection which may take place is per medium of the bull. For a number of years this animal has rather been lost sight of as a disseminator of contagious abortion, but from the fact that an outbreak often occurs following the use of one particular bull (instances

of this happened last year in the Wellington District) one cannot afford to overlook this possibility. Two ways of infection are open—mechanically by serving cow after cow with a dirty penis, or by direct injection of the bacillus of abortion in the seminal fluid among the fertilizing elements which are placed in the vagina of the cow. It is not incredible that these organisms should find their way into the uterus with the sperm, being carried by it like a jockey on a racehorse once the barrier is down, the barrier in this case being the mouth of the womb, which at the time of period is relaxed. One finds bulls reacting to tests occasionally, and in these cases the organisms may often be isolated from one or other of his genital organs.

Another factor in the spread of the disease is the carriage of the organism from one cow to another by flies, and as this is possible experimentally there seems no reason why it is not possible under field conditions. Eradication of flies, of course, should come under the sanitary arrangements of a dairy farm, whether abortion-infected or not.

In the body of the cow, on account of the war waged between the bacillus and the body-cells of the animal, there is formed a certain material known as agglutinin—an agent which causes the germs of the disease to clump together—and this forms the basis for the blood test which is used in the diagnosis of the presence or absence of the disease contagious abortion. If agglutinins are present it is known that the organism has been recently, or is, present in the body of the animal, whether in the uterus or in the udder. Thus any farmer, by taking a small bottle of blood from the ear or tail of his cow, may obtain knowledge as to whether his cow is affected or not. The agglutination test does not tell whether the cow is going to abort or how badly she is affected, but only that she is affected — which, however, is of some use. It would surprise most farmers to know what proportions of their cows are carriers of the disease, and therefore possible aborters at some time. Certain cows appear to become immune to some extent, and only abort once; but others will abort more than once, or will abort once and have several healthy calves and finally abort again. From that one cannot say confidently what will happen in a given herd.

To give an idea of the economic loss which may occur in New Zealand—not considering the actual loss of milk and calves from cows which abort before milk has been secreted—I may quote some figures which speak for themselves. They were culled from an American paper, but were obtained from a pedigreed herd and vouched for by scientific investigators. The herd was separated by test and retest into affected and non-affected animals. In the affected herd eight became permanently sterile, and in the non-affected herd none showed sterility.

	Reacting Herd. (8 Cows sterile.)	Clean Herd. (None sterile.)
Average number of cows ..	24	18
Total milk-production ..	64,447 quarts.	94,458 quarts
Total cost of production ..	£1,863 5s.	£1,720
Cost per quart	7½d.	4½d.

The question may well be asked, Does it pay to keep a badly affected herd when it is possible to clean one's herd?

Besides actual abortion one must consider the after-effects. In a proportion of cases sterility results, either temporary or more usually permanent. This often comes about from an infection by other dirt organisms, following the action of the abortion bacillus, which has reduced the tone of the genital apparatus and its resistance to disease. These parasitic organisms gain entrance to the womb itself, to the oviducts, and to the ovaries, causing abscess formation or other troubles, but rendering many animals sterile by one means or another. If abortion is reduced in a herd the number of non-breeders is automatically decreased.

As already indicated, I am not able to state a definite cure once the disease is established, but can go into the manner of dealing with a dairy herd which is affected. I shall divide the matter of prevention into two parts—one for herds only slightly infected, the other for herds badly infected. In either case the blood-samples must be tested at the Wallaceville Laboratory, and for test purposes it is as well to send about one dessertspoonful of blood in a small corked bottle marked with the name of the cow, the blood being taken into clean boiled bottles in as cleanly a manner as possible. A covering description of the herd is of very great use if forwarded at the same time as the blood-samples.

In a herd of fifty or so with, say, only 5 per cent. affected much the wiser plan is to get rid of any cows or bulls reacting to the blood test. Neighbours do not want these animals unless their herds are badly infected, and the safest place for such stock is the slaughter-house. A retest of the herd should be made from six to eight weeks later, and any reactors again eliminated. After that a test of the herd annually or biannually will give the information required to keep the herd clean. When buying in stock care should be taken to obtain animals tested before calving, or empty heifers which have not been placed to the bull previously. Such stock should be retested by the buyer at the first opportunity, even, if possible, before running them with the herd. It is said that a herd clean from the abortion point of view is also one in which contagious mammitis is only rarely seen. Personally I think this is more because the owner of such a herd is a careful farmer who rids himself of infectious stock.

In a herd badly infected the farmer must decide whether he will continue under existing conditions, suffering more or less loss in the herd annually and having all introduced stock infected, or whether he will endeavour to build up a clean herd round his affected one. This latter will depend upon the acreage and the keeping of heifer calves, and acts on the same principle followed in the eradication of tuberculosis. As non-pregnant heifers are clean, if put to a healthy bull and kept away from infected cattle and infected paddocks there is no reason why they should not remain healthy. They must be kept in separate paddocks; but it appears that if milked first in a clean shed and kept otherwise in separate holding-yards there should be no great difficulty in keeping such a herd free. Frequent tests would decide the point.

The whole position is different where the herd is a badly infected one and is to remain so, the heifers being introduced to the herd and contracting the disease at once, and obtaining what immunity they

can against it as they grow older. The chief factor under such conditions is to keep each cow which does abort well cleaned out, and to keep her isolated from the cows in calf or in milk during the time she is discharging. The discharge falling on the grass contaminates the paddocks, and so isolation is essential. All aborted material must be carefully collected and either burned or dug deeply in before dogs pull the fœtus all over the paddock and spread infection everywhere. Any mild disinfectant does for washing such cows ; corrosive sublimate or other drastic drugs should not be used, as they tend to damage the surface of the genital tract. Calves must be kept in separate paddocks from cows, for they soil the grass as effectively as do discharging cows. Bulls also require attention. Where the bull is run with the herd very little can be done to prevent spread of infection through him, but where each cow is taken separately to him (and this appears to be the wiser procedure, inasmuch as one is sure of the dates) he can be washed out between services, so making sure that he cannot infect cows mechanically. Should he be infected in the genital organs, then the agglutination test will have caught him. Washing out a bull is not difficult so long as the race or bail is strong enough to hold him, and he soon becomes reconciled to the treatment.

One other form of treatment is that of vaccination. As a live vaccine is the only one that has proved at all beneficial, it will be understood that one must be very careful how it is introduced into a herd, more especially if the herd is moderately clean, as most of the cows vaccinated become carriers. Some success for vaccination is claimed in Great Britain, and we are attempting to vaccinate a few herds in New Zealand this coming season, where the owner does not object to take the risk. This, however, is as yet only from an experimental point of view, and not as a matter of routine.

WHEAT AND OAT TRIALS AT WINTON EXPERIMENTAL AREA, SEASON 1924-25.

LAST season's wheat varieties at the Winton Experimental Area followed forage crops, and the land used for oats was ploughed out of lea. The wheat was sown on 29th August, and the oats on 15th and 16th September, 1924. The fertilizer used in both cases was basic super at 2 cwt. per acre. The yields per acre were as follows :—

Wheat: Solid-straw Tuscan, 41·4 bushels; Major, 37 bushels; Velvet, 32·3 bushels; White-straw Tuscan, 31 bushels; Marquis, 26 bushels. The Marquis variety was the first to ripen, and small birds did considerable damage, the yield being thus reduced by several bushels per acre.

Oats: Black Supreme, 89 bushels; Providence, 86 bushels; New Abundance, 70·25 bushels; Crown, 68·75 bushels; Captain, 68 bushels.

A 5-acre block of Black Tartarian oats grown for chaff returned 3·4 tons per acre.

Noxious Weeds Orders.—The Waimarino County Council has declared Californian thistle *not* to be a noxious weed within its territory.

HILL-COUNTRY GRASSLAND IN THE NORTH ISLAND.

A. H. Cockayne, Director of the Fields Division.

[This matter was published with the report of the Committee of Investigation into the deterioration of Crown lands in mid-western districts of the North Island, the main part of which appeared in last month's *Journal*.]

Hill-country grassland can be divided into two great groups—that where the objective of management is to maintain and increase the percentage of the best grazing-grasses, such as rye-grass, cocksfoot, Poa pratensis, crested dogstail, and clovers; and that where the objective is to secure and maintain as complete a grass sward as possible, irrespective of what grasses it may be composed of. In the first case the objective is to keep out as much as possible grasses, such as danthonia and brown-top, which when dominant are not conducive to high carrying-capacity of wet stock. In the other case the objective is to avoid dominance being secured by objectionable vegetation, such as one or other of the ferns, or scrub growth.

Old-established hill pastures where the best English grasses are in the ascendancy are comparatively rare except on certain very fertile soils. The larger proportion of our well-grassed hill pastures are danthonia-dominant, particularly in the drier regions; and brown-top as the dominant element is conspicuous over wide areas where the rainfall tends to be fairly heavy and the ground is not exposed to extreme drying-up in the summer. The present general system of management is tending towards increasing the dominance of danthonia and brown-top over much country that should be supporting a larger proportion of the better English grasses. Better cattle-manipulation, rational subdivision to enable areas to be summer-spelled, and the use of phosphatic top-dressing are the three main factors that are involved in the management of country where danthonia and brown-top are tending to reduce the percentage of wet stock that can be carried. In the drier parts of the North Island where fern and scrub are gaining the upper hand methods tending to an increase in danthonia are the keynotes of management; burning, sowing with danthonia, self-sowing of danthonia by sheep from danthonia country, and frequent burning of the danthonia itself are all useful. Later on, when the country becomes danthonia-dominant, efforts should be made to convert the pasture into mixed English grasses and danthonia by all those methods that tend to soil-fertility increase.

The problems of the management of our danthonia and brown-top dominant grasslands are as important as those involved in the management of the truly deteriorated hill pastures, and call aloud for extensive and well-directed research work. It has to be remembered that the danthonia and brown-top dominant grasslands have mainly developed from the surface sowing of the lands with grasses that now only represent a fraction of the herbage, the sown grasses giving out more or less rapidly and their place being taken by others more fitted for the lower soil-fertility that has been brought about largely through

the exhaustion of the surface fertility present after the initial burn. Over wide areas of the North Island, however, the initial sowing with the so-called best English grasses had not been followed, on their thinning-out, by an invasion of such grasses as danthonia and brown-top. It is country of this description that is represented in such a county as Whangamomona, where a few years' luxuriant growth of the sown grasses has been followed by invasion, in varying degrees of intensity, of objectionable second growth, most of which probably represents initial stages of reversion, with forest as a final phase. Somewhat similar experiences have not been unknown over many areas that are now well grassed in counties such as Pohangina and others. In all these, very extensive and at the time apparently destructive secondary fires have swept the country from time to time, but they have been of great value, grass-recovery having been quicker than secondary-growth recovery. It is rather significant that in a district such as Whangamomona no really general severe burning of the whole country has been experienced; and (although this is pure surmise on my part) until such has taken place I am afraid secondary growth will tend to increase rather than diminish.

The problem of secondary-growth suppression is, however, extremely complex, and varies enormously with regard to the dominant type of vegetation that has to be dealt with. In one place it may be hard fern, in another bracken, in another water-fern, in another manuka, in another wineberry or fuchsia. Our knowledge of the exact conditions that determine dominance and succession in secondary growth is extremely meagre, and exact research work in this connection is a fundamental prerequisite in the formulation of control methods. It is hardly expected that the Committee can be in a position to state definitely what methods are necessary to suppress second growth on those areas where the initial sowing with English grasses under ordinary accepted methods of management is not followed by permanent replacement by such grasses as danthonia and brown-top. The fact that such large areas of country are rapidly becoming ruined for successful pastoral occupation indicates that the present methods are unsatisfactory. As the evidence gathered together must have been secured in the main from farmers who have not been able to cope successfully and economically with secondary growth, it is clear that any recommendations they may have made can only be in the nature of surmise rather than the result of successful experience. Even in those cases where pasture-permanence has been more or less maintained—a condition that occurs scattered through the whole area under discussion—the exact reasons why partial success has been secured are obscure.

The problem appears to present two distinct phases—firstly, what should be done in order to enable present holders to hang on, as it were, to their holdings; and, secondly, the actual try-out under controlled conditions of all methods of secondary-growth suppression, in order to work out an accurate system of management that may lead to permanent and successful occupation of the land. It must not be forgotten that, as regards holdings that have almost wholly reverted to secondary growth—and this is particularly true of hard fern—there are no examples on a large scale where elimination of the secondary growth has been secured by the adoption of any definite set plan of operations.

Many surmises with regard to methods of control are in the air. These can be divided into the following groups :—

METHODS OF CONTROL.

(1.) *Increasing the number of cattle grazed.*

At the present time Whangamomona County has about one cattle-beast to every 12 acres of originally sown country, excluding the dairy cows that are occupying the majority of the better-grassed areas. In such a county as Weber, where grassland is good but mainly of the reverted danthonia and brown-top type, one cattle-beast to about 8 acres of sown grassland is kept. It would appear as if the number of cattle necessary to effect any control on second-growth country would have to be largely increased, when it is seen that even when the country is in excellent grass one cattle-beast to every 8 acres to 10 acres is necessary. In Weber County, although there is a cattle-beast to every 8 acres, the relation of cattle to sheep is one to fifteen. The proportion of cattle to sheep in Whangamomona County is about one to eight. Grassland farmers in the North Island have been in the habit of using the figure between cattle and sheep as the index, whereas it is the relation between cattle and number of acres that is the real index that determines whether sufficient cattle are being employed. On good grassed country one cattle-beast to every 8 acres to 10 acres, and even less, tends to increase the number of sheep that can be kept. For instance, in Patangata County—the highest sheep-carrying-capacity county in New Zealand—one cattle-beast to 6 acres of grassland is kept, approximately half the sheep being wet ewes.

The following table gives the numbers of stock carried per 1,000 acres of sown grassland for certain counties in the North Island :—

County.	Dairy Cows.	Other Cattle.	Sheep.
Waitomo	57	160	650
Whangamomona	28	90	700
Kawhia	44	220	730
Ohura	50	160	800
Kaitieke	30	120	1,100
Makara	70	70	1,400
Castlepoint	2	160	1,700
Akitio	6	150	1,700
Uawa	15	140	1,800
Weber	4	130	1,800
Patangata	12	170	2,000

One point that appears fairly clear is that an increase in the amount of dairying carried out leads to a very rapid deterioration of the hill country: in other words, the dairy cow is a useless factor in the control of secondary growth. The ewe, again, in contradistinction to the wether, is a factor that exerts an influence in the direction of increase in secondary growth, and much country at present partly used for wet sheep is quite unsuitable for the purpose, having permanency of the grass sward other than by artificial manuring in consideration. However, both the dairy cow and the ewe are potent sources of immediate

revenue, and their elimination on holdings where secondary growth is rapidly gaining the upper hand would render the immediate returns from such holdings quite insufficient for the owners to remain in occupation unless their finance was in good shape—a comparatively rare circumstance even at the present time, when meat, wool, and butter-fat are all on a high level.

On land where the sheep-carrying capacity is low, owing to the large proportion of ground being occupied by secondary growth, increasing the number of cattle must (unlike on good danthonia country) tend to reduce the number of sheep kept, and, as the yearly grazing-value of a store cattle-beast is low, this would cause a reduction in the gross annual returns. A surprising feature in the deteriorated grass-lands of Whangamomona County is the really high carrying-capacity of the land actually carrying a grass sward. In that county 108,000 acres of forest have been grassed, and I should say at a guess more than 40 per cent. is occupied now by secondary growth. There are probably less than 50,000 acres of actual good grass, of which 3,000 dairy cows will be occupying at least 9,000 acres, which means that the actual grassland itself is carrying virtually two sheep to the acre. Were it not for this fact one would have the very gravest doubts as to whether it were worth while either to try and assist the present holders or to suggest any extensive research and experimental work into the question of secondary-growth suppression on such country.

I think it is fair to assume that an increase in cattle would tend to reduce second-growth invasion, and if such is the case the practical aspects require careful consideration. On country that is moderately clean the extension in the use of cattle would not result in any great yearly loss; but it is essential that a thorough study of the economics of cattle as a means of control should be immediately made, so far as possible, with reference to all the varied types of country. This study should secure the basis for a series of experiments on the effects of cattle-stocking at varying degrees of intensity, and the acreage cost of keeping the cattle under different systems of management, such as where breeding can be done, where cattle can be kept throughout the year, and where cattle have to be periodically bought and sold. The relation of fencing to the density of cattle-stocking, and the variation in the acreage cost of necessary fencing according to the size of the holding and the acreage density of cattle kept, are important. With fairly reliable information under these heads it might be possible to outline methods for the Government financing of cattle-purchase, with a reasonable expectation that the costs would be finally recoverable. Personally I might add that I do not consider that a mere increase in the cattle kept will be found economically sound except where the holdings are comparatively large. Fencing-costs, reduction in sheep carried, the increased cattle-density necessary compared with that of large holdings, and the necessity of often having to buy on a high market and sell in a low one, preclude cattle being the sheet-anchor of control on small holdings.

(2.) *Introduction of grasses and clovers more likely to be permanent and resist second-growth invasion than the standard English grasses.*

Roughly expressed, it may be said that the hope of every holder of second-growth invaded country is that the country will turn into

danthonia grassland, as has been the experience on much of the surface-sown hill lands of the North Island. Danthonia, however, belongs to the class of grasses known as light-demanders, and cannot possibly obtain the upper hand when shaded. Danthonia will not endure even a moderate amount of shade, and is likewise not particularly tolerant of an extremely wet climate. A wet climate is, on the other hand, of great benefit to the development of secondary growth. Again, provided it is not shaded, danthonia prefers well-consolidated rather than loose land. Generally speaking, all the conditions for rapid danthonia-spread are absent from the country that has so badly reverted to second growth, and unless methods favouring its development can be adopted in the region in question there is no reason to believe that danthonia will become generally dominant unless the amount of burning done can be vastly increased. On sunny faces, provided fern and scrub growth is kept out, danthonia is always likely to become established and spread, irrespective of whether it is intentionally sown or not. It is generally admitted that intentional sowing will lead to more rapid establishment than where no sowing is done, but actual sowing of danthonia, particularly in combination with other grasses, is often extremely disappointing. Burning, by removing shade, frequently has a marked effect on danthonia-spread, and in fact, in the past, has been one of the main factors that has led to its dominance over wide areas.

The establishment of a close and continuous sward of some grass or combination of grasses is essential in the suppression of secondary growth, and the fact is being strikingly demonstrated that the only type of grasses that are likely to be suitable in this respect are those that are capable of spreading on soils of low surface fertility. The main grasses that come to one's mind are danthonia (work on the fertility and shade factors with regard to the different forms of the pilosa, racemosa, and semiannularis groups may yield very significant results); brown-top and its forms; ratstail; tall oat-grass (perhaps on account of its suitability for loose soils); paspalum; and perhaps tall fescue. It would appear as if it were essential to try and make one or other of these grasses the dominant one on second-growth country, so that wherever any thinning-out took place the likelihood would be that the vacant spaces would be seized on by grass rather than by undesirable vegetation. Other grasses, such as crested dogstail, Poa pratensis, and *Microlaena*, are all likely to prove useful. Rye-grass most certainly should never be sown on burnt-out patches of secondary growth, except perhaps where the soil-fertility is still high and the value of cocksfoot is more than doubtful.

Generally speaking, the reasoning that has been adopted in the past on initial sowings is that the mixture should contain a combination of the better grasses which keep going for a few years and a certain amount of such grasses as danthonia and brown-top to occupy the ground rendered vacant by the thinning-out of such grasses as rye and cocksfoot. Whether this reasoning is really sound or not I rather have my doubts. Unfortunately, in much of the present deteriorated country only rye-grass/cocksfoot mixtures with a small proportion of crested dogstail and clovers have been sown, and the sowing of combined high-fertility elements and low-fertility elements together on the

initial burn has not been under any exact observation. Were I advising on the sowing-down of initial burns of Whangamomona district country at the present time I should be inclined to exclude all ryegrasses and cocksfoot, and make brown-top, danthonia, crested dogstail, paspalum, and Poa pratensis the only grasses to use, together with white clover (the question of wild white clover is one that must be investigated on hill pastures), suckling-clover, Lotus major, and perhaps subterranean clover. I would likewise be inclined to sow a certain amount of fog, particularly if the burn was not a really good one.

Quite apart from the mixtures to be used on land where the original sowing has been replaced by secondary growth comes the question of the formation of the seed-bed and whether the seed should be mixed with manure. One can divide the types of vegetation on which reseeding should be done into hard fern, bracken fern, water-fern, manuka, and particularly pasture that is thinning out but may not be seriously invaded by second growth. On this last type of vegetation a seed-bed cannot be secured by burning, and in attempting the renovation of such a sward I would advise the sowing of brown-top and crested dogstail with about 1½ cwt. of super per acre on the dark faces, and brown-top, danthonia, crested dogstail, and paspalum together with manure on the sunny faces. Lotus major and perhaps subterranean should be the main clovers used. In the sowing of second growth of all kinds a seed-bed formed by burning the growth, either standing or with some prior treatment depending on its type, naturally would take place, and I would again make what are generally looked upon as the poorer grasses and clovers the only ones to be used.

One of the outstanding difficulties of the introduction of grasses and clovers to second-growth country is the fact that all the species of any value are exceedingly high in price, and if any heavy seeding is carried out the cost is excessive. The present experimental areas in the Whangamomona district are of very great value in this direction, and present indications are that brown-top can be established easily, rapidly, and with quite a light seeding. Following are the approximate prices per pound of grasses and clovers likely to prove valuable: Brown-top, 3s.; Danthonia pilosa, 2s.; Danthonia semiannularis, 2s.; crested dogstail, 1s.; paspalum, 1s. 6d.; Poa pratensis, 1s. 6d.; ratstail, 2s. 6d.; Lotus major, 3s. 6d.; subterranean clover, 6s. The question of a cheapening of these seeds is one of great importance, and the matter of financial assistance by the Government enabling a combination of farmers to grow their own requirements should be considered. I do not mean the growing of the seed in the districts themselves, but the actual establishment of a seed-growing farm—say, for brown-top—in whatever district is most suitable; financial assistance to secure supplies of danthonia-seed, and the like. A careful study of the present experiments in operation should prove most valuable in working out what mixtures are best, and a considerable extension of the work in progress should be undertaken.

(3.) *Phosphatic top-dressing of second-growth grassland.*

The wonderful results that have followed the top-dressing of worn-out grassland in many parts of New Zealand have led to the general

idea that in top-dressing lies the salvation of the second-growth grasslands of the North. There is no doubt that top-dressing, rationally carried out, will prove of great value, but just how, when, and where top-dressing should be done is hard to answer satisfactorily. Top-dressing of weak grassland and of any portions that are moderately well grassed appears to me to be sound under nearly all circumstances. Top-dressing will increase the feed produced and thereby increase the stock carried, and increase in stock-carrying capacity is perhaps the most potent factor of all in the control of second growth. There are, however, certain points that have to be considered. Firstly, the amount of fertilizer material necessary may have to be fairly large, and repetition of application necessary before any decided advantage is secured—which means that top-dressing will be expensive; secondly, the most striking immediate results will be secured from the better-grassed areas. As these areas will mainly be on the flats and lower slopes, top-dressing them will tend to keep stock only on the top-dressed areas, and, unless fenced off, the tendency will be for stock not to penetrate at all the higher slopes, and second growth may in this way be increased rather than diminished. This is perhaps a more important point than is generally considered.

The cost of hand distribution of artificial manure need not be considered, as the ordinary labour of the farm can in all cases do all that is necessary. In point of fact, methods whereby the actual manual work of the owner can be devoted to the control of second-growth suppression have not as yet been given the attention they deserve. It will be noted that the three great generally suggested methods of control—increasing cattle, the sowing of low-fertility-demanding grasses, and top-dressing—are all expensive and require considerable capital, whereas the one method of management that does not in many cases require any additional capital — actual mechanical control by hand labour — has as yet not been vigorously applied. It is remarkable that on many holdings considerable manual work is willingly undertaken against vegetation that is of no moment whatever, particularly against foxglove, whereas against the really serious invaders the farmer is content to put forward suggestions of getting some other agency to do the work for him — namely, cattle, grass-seed, and artificial manure.

I have mentioned with regard to cattle the necessity for extended scientific investigation, and the same holds true with regard to resowing, top-dressing, and manual treatment. The work should not be carried out on any one special experimental farm, but adequate funds should be available to put under trial conditions on many farms all possible methods of management. In addition to the actual money required for cattle, fencing, seed, and manures, expert scientific supervision is necessary, and extra assistance should be provided for Mr. E. B. Levy (Agrostologist). I would also suggest that a very complete study of the economics of hill-country grassland farming should be carried on simultaneously with any experimental work undertaken, and that for this purpose a small branch of the Fields Division be formed devoted to the study of agricultural economic problems, among which, to begin with, the question of the economics of second-growth country should be carefully studied.

(4.) *What should be done to relieve the present unsatisfactory condition of many holdings.*

In the foregoing I have indicated the four great methods of secondary-growth suppression that have been suggested—cattle, resowing with low-fertility-demanding grasses, top-dressing, and direct manual labour. With regard to the efficacy of these methods, under what conditions they should be put into operation, their costs and probable returns, very little of any definite value is known, and accordingly the foundation of a policy of assistance is sadly handicapped. Why have the holdings gone back? is the question that requires answering, and probably in ninety-nine cases out of a hundred the holder will say, "Through lack of sufficient capital to adequately work the holding." Just what capital is required to keep such grassland in good order? Does it vary per acre according to whether the holding is a small or large one? Would in many cases the money required be greater than any ultimate value of the land? Personally I consider that the country has gone back for several reasons. Firstly, the original sowings, being mainly rye-grass and cocksfoot, were quite unsuitable for any but the flat land and more fertile portions of the lower slopes; secondly, it was not recognized that the cost of maintaining such country in grass was much higher than currently supposed. The non-recognition of this fact led to excessive values being credited to the land, and in consequence an excessive percentage of the returns had to be swallowed up in rent, rates, and interest on fictitiously high values.

I would suggest that a survey of the deteriorated holdings be made, and that they be divided into the following classes: (*a*) Holdings that in their present condition cannot produce sufficient money annually to defray their annual financial obligations; (*b*) holdings that in their present condition can return sufficient to defray financial obligations, but cannot support in a reasonable manner the holder and his family; (*c*) holdings that in their present condition can defray annual expenses and support the holders, but with insufficient left over to put back into the properties to maintain or improve them; (*d*) holdings that in their present condition can support all their financial obligations and enough to maintain and improve them.

The first type of holding should be abandoned, or in certain cases be combined with other holdings. The second type should have the interest charges lowered. The third type should have liberal assistance given, provided the holders are deficient in capital. Nothing should be done with the fourth type of holding. No doubt a considerable number of holdings will have to be abandoned, and be taken over later by other owners who have good properties, who by their aid may be able to break in the country. I should like to add here that excessively small holdings have been in the past a potent factor in failure to maintain a grass sward on much hill country.

I would suggest that the following main principles should be adopted in the giving of assistance: (1.) No Government rent to be charged for land in forest or which has completely reverted to second growth. (2.) Expenditure on fencing, seeds, and manures used for reasonable improvement purposes to be accepted in lieu of rent.

(3.) Methods adopted whereby mortgages are reduced when it is clear that they, in combination with other charges, exceed the present value of the land, and where the land cannot in its present state provide for annual payment and allow a holder sufficient money to live in a reasonable manner. (4.) Expenditure on fencing, seeds, and manure to be accepted in lieu of a certain portion of the interest charges, arrangements being made whereby such interest waived may afterwards be recovered if the land is sold at a profit. (5.) Advance of Government money for the purchase of cattle. (6.) Free railage of manure. (7.) All cases where assistance is to be rendered to be investigated by a competent Board representing the interests of the Government, the State Advances, the Public Trust, and private mortgagors and owners, before any help is given.

In all cases the probability of the land finally fully recovering all costs that may be incurred should be carefully considered, and, where expenditure is held to be justified, all those interests that have an equity in the holding should share in the expenditure before the Consolidated Fund is called upon. Rent-remissions and mortgage-reductions in themselves will not improve the country. Their equivalent must go back into the land if stability of occupation is to be secured.

PASTURE TOP-DRESSING TRIALS AT TE KUMI.

FURTHER PROGRESS RESULTS.

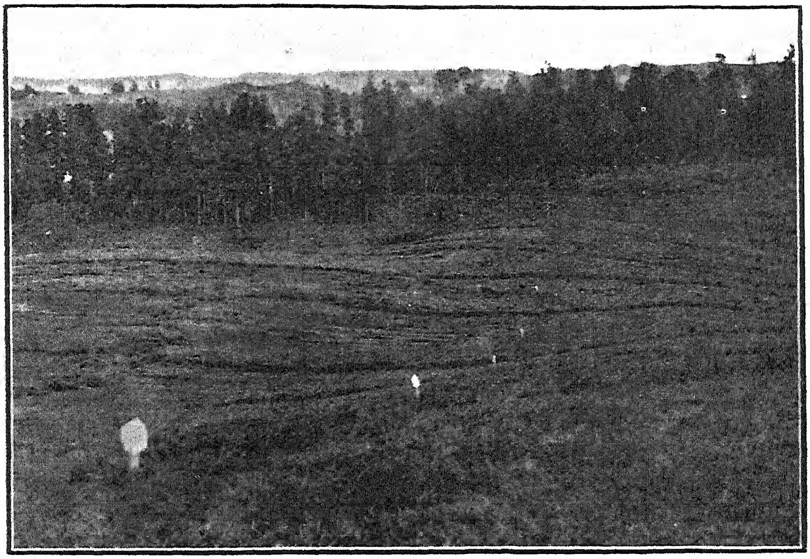
T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

THE experiments dealt with in this and two earlier progress reports (*Journal*, May, 1922, and April, 1923) are part of a series of top-dressing trials on pastures in the Auckland Province. The object set out was to determine the relative economic values of the commoner phosphatic fertilizers used by farmers for top-dressing. The trials were commenced four years ago. Ground raw rock phosphate, basic slag, and superphosphate have, during that period, been tested side by side with control areas which have not received any fertilizer. Plots were set out at Pukekohe, on medium volcanic loam of good quality; at Te Kumi, near Te Kuiti, on undulating ploughable fern-land, the soil being a light loam with a subsoil stiffer in nature; and at Helensville, on the Parakai Flats, on heavy alluvial soil of first-class quality. The method used for comparing the value of one fertilizer with another has been twofold: (1) To carefully weigh the hay cut from the plots and compare the weights thus obtained; and (2) to regularly examine the pastures on the plots at different seasons throughout the year, and record any changes noted in the pasture. Particular attention has been given to any improvement from the grazing standpoint.

Though results have been published from the Te Kumi trials, no reports have officially appeared of the results at Pukekohe nor Helensville. The reason for withholding the results so far secured at

these places has been that while there was a distinct improvement from phosphatic manuring at Pukekohe, but a much less response with all fertilizers at Helensville, the comparative differences in yield brought about by the different fertilizers were not considered great enough to place as yet sufficient reliance on them as real. Subjecting the results to statistical examination has merely confirmed this opinion.

With the Te Kumi results the response to superphosphate both on the limed and unlimed plots, as compared with the other fertilizers, has been all through very significant. The increases brought about, after allowance made for experimental error, have been as high as 75 per cent. over and above the yields of the areas which received no



GENERAL VIEW OF THE TE KUMI PLOTS.

manure. The increases due to slag and ground rock phosphate have been marked when compared with the controls, but the slight difference recorded between these two last mentioned cannot be regarded with certainty as real.

It must be remembered that the plots were dressed in 1921 and 1922 with the various fertilizers at the rate of 3 cwt. per acre. They were again treated early in June, 1923. As the plots were not shut up for hay in the 1923–24 season, the area was grazed with dairy cows throughout that period, except for one month after 26th October, when all stock were removed and notes made on the pastures of the different plots.

The plots were dressed with fertilizers again on 9th and 10th July, 1924. All stock were removed on 30th September, and the plots cut for hay in the first week of January of this year.

YIELDS OF HAY.

Table 1 gives the yields of hay and other information for the season 1924–25. The residual effect of the fertilizer dressings applied previously has no doubt shown up in the returns given.

Table 1.

Fertilizer used.	Amount per Acre.	Hay-yield per Acre.	Increase over Check per Acre.	Percentage Increase over Check.
Unlimed Plots.		Cwt.	Cwt.	
Check	No manure	25·5	..	..
Basic slag	3 cwt.	43·7	18·2	71
Superphosphate ..	,,	51·4	25·9	101
Rock phosphate ..	,,	44·6	19·1	75
Limed Plots.				
Superphosphate ..	3 cwt.	47·1	21·6	85
Rock phosphate ..	,,	38·0	12·5	50

As far as weight of hay goes, the plots which were dressed with superphosphate have again shown their superiority over the slag and rock-phosphate plots. In spite of the difference in yields (which may be real) between the super on the limed and the unlimed plots, the apparent superiority of super as against super and lime was not found to be significant when the results were tested statistically. The lower yield indicated was probably due to soil-variation, a fact which was not known or anticipated when the trials were first established. Though rock phosphate would appear to be better than basic slag, the slight difference in yield may not be real. It is interesting, however, to see that ground rock phosphate compares favourably with slag. All fertilizers gave a satisfactory response.

VALUE OF THE HAY.

One may take another view of the observed increases shown in Table 1. Considering them for the season under review, and not attempting to make any allowance for the residual effect of the three applications of fertilizer previous to 1924, the money value of hay provides interesting information. Meadow hay at the time of writing is offered for sale in Auckland at from £7 to £9 a ton. Costing the value of the hay at even £5 a ton, and the fertilizers in each case being delivered at Te Kumi railway-siding (lime costed at 1s. per hundredweight, and 4 cwt. per acre allowed), Table 2 gives some useful comparisons.

Table 2.

Fertilizer used.	Hay Increase over Checks per Acre.	Value of Increase (Hay £5 per Ton).	Cost of Fertilizer (including Freight).	Profit per Acre.
Unlimed Plots.	Cwt.	£ s. d.	£ s. d.	£ s. d.
Check	..	..	..	..
Basic slag	18·2	4 11 0	0 16 7	3 14 5
Superphosphate ..	25·9	6 9 6	0 18 10	5 10 8
Rock phosphate ..	19·1	4 15 6	0 17 9	3 17 9
Limed Plots.				
Superphosphate ..	21·6	5 8 0	1 2 10	4 5 2
Rock phosphate ..	12·5	3 2 6	1 1 9	2 0 9

It will be seen that in every case the use of the fertilizer pays even if only the seasonal cut of hay is considered, apart from the general benefit accruing to the pasture throughout the whole season.

IMPROVEMENT IN PASTURE.

It was mentioned previously that the valuation of the pasture-improvement was based on observations made from time to time by officers of the Fields Division, and also opinions of farmers. The consensus of opinion has been that the plots which received superphosphate and lime possessed the best sward throughout the period of the trials. Just before cutting for hay the following notes were made :—

Superphosphate (on limed area) : Sward dense, vigorous, and of good deep-green colour, due to healthy appearance of cocksfoot, rye-grasses, and bottom growth. Clovers prominent. Weeds not noticeable.

Superphosphate : Considered second to super and lime, but weeds like Yorkshire fog, catsear, dandelion, cud, and tarweed noticeable. Otherwise a good sward, promising a heavy yield.

Slag : Quantity of growth less than on superphosphate plots. Sward is patchy where good grasses and clovers are weak. Colour and density of sward otherwise good, except on patches just mentioned.

Rock phosphate : Sward somewhat disappointing. Bracken fern and weeds obvious. These plots, however, have improved considerably. White clover noticeable and well distributed.

Rock phosphate (on unlimed area) : Pasture poor, though much improved since previous year. Poor colour. Fern and weeds very obvious.

Check (no manure) : These plots look starved. Good grasses holding on with difficulty. Inferior grasses and weeds, including fern, prominent, and have increased since 1921. Stock more or less neglect these plots.

In the autumn and winter the slag plots have each season shown to advantage, having been almost equal in appearance to the superphosphate-lime plots. Only on the unmanured plots does one find grass-stems and other growth dried up and left without being eaten by stock during these periods of the season These latter plots appear brown and starved.

FOUR YEARS' REVIEW.

Table 3 gives the separate weighings of three seasons, and the averages of these since the trials were commenced.

Table 3 (Hay-yields per Acre).

Fertilizer used.	1921.	1922.	1923.	1924.	Average of Three Weighings.
Unlimed Plots.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Check	23·5	22·4	Not cut for hay.	25·5	23·8
Superphosphate ..	41·2	44·3		51·4	45·6
Basic slag	29·1	35·8		43·7	36·2
Rock phosphate ..	29·3	32·5		44·6	35·4
Limed Plots.					
Superphosphate ..	41·6	38·6		47·1	42·4
Rock phosphate ..	27·4	27·6		38·0	31·0
Rainfall at Te Kuiti ..	56·8 in.	53·85 in.	51·87 in.	71·46 in.	..
Number of rainy days ..	166	161	168	179	..

The average rainfall for Te Kuiti over a ten-year period is 60 in. These records were kindly supplied by Mr. J. N. Hamlin, Bank of New Zealand, Te Kuiti, to whom thanks are due.

COMMENT.

(1.) The response to all phosphatic fertilizers at Te Kumi is marked.

(2.) On a basis of odds of 30 to 1 (which is considered practical certainty), slag and ground rock phosphate have given yields of about 40 per cent. over and above the check plots. While the improvement brought about by these fertilizers is very satisfactory, they only suffer by comparison with superphosphate. Super appears to be the most profitable fertilizer to use where conditions are similar to those at Te Kumi.

(3.) Results so far show no differences between slag and rock phosphate which can be considered real. Only further results gained by repetition of these trials can give the answer. The same can be said in reference to the Pukekohe and Parakai trials. Attention is drawn to the progressive improvement recorded each year in the hay-yields from slag and rock phosphate since the trials were started at Te Kumi. This improvement is also shown from inspection of the pasture.

(4.) Since rock phosphate compares favourably with slag, the practice of using a mixture—slag or rock phosphate with superphosphate—is a sound one. While it is almost a general experience in New Zealand and elsewhere that lime combined with ground rock phosphate tends to lower the yields of crops, the opposite is generally true when lime is used with superphosphate. The explanation offered for the slightly decreased hay-yields at Te Kumi is most probably the soil-variation, which we now know generally favoured the unlimed plots. In spite of the soil factor, however, the best sward from a grazing point of view is seen on the super-lime plots, where clover-growth is exceptionally good. Super alone tends to stimulate the grass-growth and weed-growth, all of which shows up in the weights of hay taken.

(5.) After further weighings are made at Te Kumi and the other areas, more available evidence will allow of even more definite conclusions to be drawn. However, the convincing evidence so far of the value of top-dressing pastures with phosphatic fertilizers makes one wonder why any farmers neglect such a ready, profitable, and sure means of improving their grassland.

I wish to thank Professor P. W. Burbidge, of Auckland University College, for his assistance with the statistical examination of the results, and also Mr. G. A. Holmes, M.Sc., B.Ag., of Ruakura Farm of Instruction, who checked the results at Te Kumi. My thanks are also due to the members of the Fields Division, Auckland, and to Mr. Charles Harrison, Te Kumi (owner of the property on which the plots are located), whose co-operation and help have been freely given.

The individual plot yields will be gladly supplied to those interested in the full records of these trials if application is made to the Department of Agriculture.

IMPROVED STRAINS OF NEW ZEALAND OATS.

COLLEGE ALGERIANS, DUNS, AND DANISH.

F. W. HILGENDORF, D.Sc., Biologist, Canterbury Agricultural College, Lincoln.

IN 1910 the Board of Governors of Lincoln College undertook the work of improving the wheats of Canterbury, and during the following ten years succeeded in producing College Hunter's, College Tuscan, and College Velvet, all improved strains of the standard varieties. A start had also been made on the selection of Algerian oats. By 1920 the work of maintaining the purity of these strains was taxing the slender resources of the College, and the Department of Agriculture made a grant of £500 a year towards the expenses of further improving wheats by cross-breeding, and of improving other standard varieties of oats by selection. The crossing of wheats has not yet produced grain for farmers' use, but the selection of oats has had results worth putting on record. Four varieties were used for selection—namely, Algerians, Gartons, Duns, and Danish.

ALGERIANS.

The strain A86, reported on in this *Journal* for March, 1923, has been on the market since that date under the name of College Algerians. It has obtained a considerable degree of favour, as is evidenced by the facts that in the sowing season just passed the seed was quoted in market reports at 6d. per bushel above ordinary seed, and that two Canterbury firms between them sold 20,200 bushels of seed, of which 3,000 bushels were for the North Island. The reports received indicate that the strain has maintained a superiority of about 10 per cent. over unselected seed.

GARTONS.

In the variety locally known as Gartons, but elsewhere as Garton's Abundance, the selection has failed to disclose a strain superior in yield to the commercial seed already on the market. This is probably because Abundance is the subject of continuous careful selection by Messrs. Garton in England. It is notoriously difficult to strike an improvement in a variety produced by good mass selection; while if the original selection has been pushed so far as to produce a pure line, then all future selection—so long as the line remains pure—must be quite without result.

DUNS.

A selection has been made from commercial Dun oats, and a pure line bred up from it until a merchantable quantity of the grain has been obtained. This is now on the market under the name of College Duns. All the grain sold under that name is the progeny of a single seed, as the following history of the selection will show :—

1920.—At harvest selected many hundred heads of promising types from a farmer's commercial crop. By further selection in the laboratory reduced these heads to 100, selecting those with most grain,

thinnest husk, least awn, and firmest chaff. In May sowed the seed of each head in a separate row in a bird-proof enclosure.

1921.—Harvested and threshed each row separately, and found that a certain strain numbered A31 was the fourth-highest yielder out of the hundred. This strain and nine others were kept, and in May each strain was sown in a separate plot, the seed obtained from the row being sufficient to sow a plot one-fiftieth of an acre in extent.

1922.—Harvested the ten plots and threshed each separately. Strain A31 was the third-best yielder, producing at the rate of 79 bushels per acre, while the average yield of the other plots was 71·9 bushels per acre. The seed from the three best plots was sown in May in plots in another field, each strain being sown over two plots each one-third of an acre in extent.

1923.—The three strains were threshed separately, and A31 yielded an average of 86·7 bushels per acre, while the others averaged 81·8 bushels. During the years that these first selections had been under trial new selections had continuously been made from farmers' crops, and, by yield trials similar to those described above, had been reduced in number till only the best remained. In May, 1923, five of these newer selections, and the three original strains of which A31 was one, and the best seed that could be bought, were put under a more elaborate trial. Five plots of each of the nine kinds were sown chessboard-wise scattered over a field — making forty-five plots of Duns, each one-tenth of an acre in extent.

1924.—Each of the forty-five plots was harvested separately, and A31 gave the best yield on the average of its five plots. Its yields were 41, 44, 56, 47, and 46 bushels per acre, an average of 46·8, while the commercial seed yielded an average of 44·1 bushels. The best three on this trial were saved and sown in May, 1924, by the half-drill strip method. The fifteen-coulter drill had its middle coulter blocked up, and one-half of the seed-box filled with commercial seed and the other half with the seed of the strain, the drill being then driven wheel on wheel-mark. This method gives alternate plots of the commercial seed and the strain, separated by the absence of one row, as many times repeated as the drill is driven up and down the field. Of each of the three best strains, twelve double plots were thus sown, putting each strain in competition with commercial seed. Each plot was 7 chains long, and it will be seen that great reliance can be placed on the result of such a trial, owing to the length, the number, and the close proximity of the competing plots.

1925.—The strain A31 gave an increased yield over the commercial seed; both the other strains tried also beat the commercial seed, but not so certainly or so constantly as strain A31 did. The twelve double plots were reduced to ten to get rid of the disturbance in yield produced by outside rows, and at harvest each of the ten long plots was divided into three lengthwise, thus giving thirty plots for comparison—that is, thirty plots of the strain and thirty of the commercial seed.

The yields in bushels per acre are shown in Table 1. There is not supposed, by the scheme of the experiment, to be a close similarity between the figures of the first columns when read vertically, as these are records of plots of slightly different sizes and on different soils. The similarity is supposed to be in the differences of any pairs of plots

read horizontally. For instance, the two plots numbered 5 were both large or were on good ground, and so gave a high yield; while the two plots numbered 6 were small or on poor ground, and so gave a low yield. But, since strain and commercial were sown close side by side in each pair, the *difference* in yield is nearly constant—5 bushels in one case and 6 bushels in the other.

Table 1.—Yields of Dun Oat Plots in 1924–25.

Paired Plots Numbers.	Yield in Bushels per Acre.		Difference in Favour of		Paired Plots Numbers.	Yield in Bushels per Acre.		Difference in Favour of	
	Commercial Seed.	Strain A31.	Commercial Seed.	Strain A31.		Commercial Seed.	Strain A31.	Commercial Seed.	Strain A31.
	Bushels.	Bushels.	Bushels.	Bushels.		Bushels.	Bushels.	Bushels.	Bushels.
1	75·5	83·0	..	7·5	17	69·5	71·5	..	2·0
2	85·0	87·0	..	2·0	18	68·0	71·0	..	3·0
3	84·0	89·0	..	5·0	19	72·0	76·5	..	4·5
4	87·0	97·0	..	10·0	20	65·0	66·5	..	1·5
5	90·5	95·5	..	5·0	21	64·5	68·0	..	3·5
6	69·5	75·5	..	6·0	22	69·5	71·5	..	2·0
7	77·0	77·0	..	..	23	66·0	71·0	..	5·0
8	70·0	74·5	..	4·5	24	66·0	64·0	2·0	..
9	66·5	69·5	..	3·0	25	67·0	66·5	0·5	..
10	65·0	71·0	..	6·0	26	83·5	84·0	..	0·5
11	75·0	82·0	..	7·0	27	91·5	91·5	..	..
12	66·5	78·0	..	11·5	28	89·0	93·5	..	4·5
13	75·0	76·5	..	1·5	29	87·5	90·5	..	3·0
14	63·5	75·5	..	12·0	30	86·5	87·0	..	0·5
15	80·0	81·5	..	1·5					
16	76·5	79·0	..	2·5	Aver.	75·0	78·8	..	3·7

Thus in twenty-six out of the thirty trials the strain A31 yielded more than the commercial seed sown in closest proximity to it. The average superiority of the strain was $3\frac{3}{4}$ bushels per acre, or 5 per cent.*

After such a complete trial, in which the strain showed so consistent a superiority over the commercial seed, it was felt safe to conclude that strain A31 was a better yielder than the best seed at the time obtainable, and it was determined to put the strain on the market under the name of College Duns.

From the harvest of 1923 two sacks of seed had been kept, as the small number of plots in that year had conduced to purity of seed. When the 1924 harvest indicated the high promise of strain A31 the two saved sacks of seed were sown in a block in a separate field, and yielded about 93 bushels per acre. Thus when the trials of 1924–25 gave conclusive evidence of the merit of the strain there were available for distribution 350 bushels of seed that had not undergone risk of adulteration in the many plotted trials of the two final years. These 350 bushels were therefore sold to farmers customarily growing Dun oats, and it is expected that the College strain will soon become widely distributed.

* It will be observed that the trial was after Beaven's design, and the calculation of the probable error of the differences made by "Student's" method. Differences were calculated as percentages of commercial: Mean diff. $+ 4{\cdot}89\,\%$: σ diff. $4{\cdot}52\ \%$ $\therefore Z = 1{\cdot}08$: $N = 30$ $\therefore$ by Love's Tables odds $> 9{,}999$ to 1.

Summary of Performances of College Duns.

1920–21 : Single row. Third out of one hundred strains.

1921–22 : Fiftieth-of-acre plot. Third out of ten best strains. Yield, 79 bushels per acre ; average of others, 72 bushels.

1922–23 : Two plots, each one-fifth acre. Best of three best strains. Yield, 86·7 bushels per acre ; average of others, 81·8 bushels.

1923–24 : Five plots, each one-tenth acre. Best of nine strains tried. Yield, 46·8 bushels per acre ; commercial, 44·1 bushels per acre.

1924–25 : Thirty plots beside thirty commercials. Superior in twenty-six out of thirty trials. Yield, 78·8 bushels per acre ; commercial, 75 bushels.

Average superiority of strain for four years, 4·4 bushels per acre = 6·6 per cent.

College Duns are indistinguishable from the commercial seed—except, of course, by greater evenness of sample and of growth and maturity. Its response to feeding off in spring has not been investigated, but its very similar habit of growth to that of commercial Duns leads one to expect similar growth after feeding off. The evenness of ripening to be expected in a pure strain has a very advantageous effect in this instance, as the bulk of the crop is ripe before the top grains begin to shake.

DANISH.

The selection of the old Danish variety—once a popular feed oat in Canterbury—proceeded at the same time and in the same manner as in the case of Duns. To avoid wearisome repetition, only the results of the trials will be given, the method of attaining the result being in every case similar to that used with the Duns in the same year. The summary is as follows :—

1920–21 : Single rows. Sixth out of one hundred strains.

1921–22 : Fiftieth-of-acre plots. Second out of ten best strains. Yield, 81·4 bushels per acre ; average of rest, 79·2 bushels.

1922–23 : Two plots, each one-fifth acre. Best of three best strains. Yield, 76·9 bushels per acre ; average of rest, 73·9 bushels.

1923–24 : Five plots, each one-tenth acre. Best of seven. Yield, 45·8 bushels per acre ; commercial, 42·0 bushels.

In 1924–25 the half-drill strip method was used, and, although thirty pairs of plots were sown, various accidents, from drilling to threshing, reduced the strictly comparable pairs to twenty-two. Their yields are shown in Table 2 (on opposite page), comparable plots again being recorded on the same horizontal line. It will be seen that here the strain showed better than the commercial in eighteen out of the twenty-two trials, and although the superiority of the strain was not so constant as in the case of the Duns, yet it is sufficiently convincing.*

* Again Beaven's design of plots and "Student's" calculations were used. In percentages of commercial: Mean diff. $= + 5{\cdot}2\%$: σ diff. $= 6{\cdot}4\%$ $\therefore \frac{M}{\sigma} = Z = \frac{5{\cdot}2}{6{\cdot}4} = {\cdot}81$: $N = 22$ $\therefore$ by Love's tables odds = 1,500 to 1.

Table 2.—Yields of Danish Oat Plots, 1924–25.

Paired Plots Numbers.	Yield in Bushels per Acre.		Difference in Favour of		Paired Plots Numbers.	Yield in Bushels per Acre.		Difference in Favour of	
	Commercial.	Strain.	Commercial.	Strain.		Commercial.	Strain.	Commercial.	Strain.
	Bushels.	Bushels.	Bushels.	Bushels.		Bushels.	Bushels.	Bushels.	Bushels.
1	87·0	91·5	..	4·5	13	74·0	73 5	0·5	..
2	92·0	90·5	1·5	..	14	75·0	71·0	4·0	..
3	80·5	87·0	..	6·5	15	76·5	80·0	..	3·5
4	61·5	64·0	..	2·5	16	67·0	67·5	..	0·5
5	66·0	69·0	..	3·0	17	70·0	66·0	4·0	..
6	69·0	87·0	..	18·0	18	61·5	63·5	..	2·0
7	67·5	71·0	..	3·5	19	87 5	90·5	..	3·0
8	67·5	72·5	..	5·0	20	87·5	90·0	..	2·5
9	78·5	82·0	..	3·5	21	85·0	95·0	..	10·0
10	73·0	76·5	..	3·5	22	87·0	95·5	..	8·5
11	67·5	78·5	..	11·0					
12	69·0	73·5	..	4·5	Aver.	75·0	78·9	..	3·9

The average superiority of the strain during the last four years of test was about 3½ bushels per acre, and this was over a mixture of Gartons and Danish, as a pure commercial Danish was unobtainable.

It was therefore decided to offer this strain for sale under the name of College Danish, as a line of about 300 bushels of pure seed had been grown under the same conditions as the pure Duns. This lot has been distributed to farmers usually growing Danish oats, and it is anticipated that the strain will be distributed to wherever the variety is in favour. College Danish is a winter oat of vigorous growth, much like that of Gartons. Its reaction to feeding off has not been tested. It has a rather tall stout straw and bold spreading head. The yield is high, and the grain of a full yellow colour.

GENERAL.

In regard to these strains a word of warning is necessary. We do not say that College Duns or College Danish is a better oat than Algerian or Gartons or any other. What we do say is, If Duns or Danish is the best oat for your land, then College Duns or College Danish will probably give a somewhat better yield than your old seed.

Demand for Light-weight Mutton.—" A review of the prices ruling on Smithfield during the last few years," states the 1924–25 annual report of the Meat Producers' Board, " shows a decided tendency to light-weight mutton. In previous days the difference between light-weight and heavy-weight mutton was a matter of farthings. To-day the difference is pence per pound, so decided and emphatic is the preference for light mutton of good quality. There is always a demand for a limited amount of heavy-weight mutton on Smithfield, which is more than fully supplied from other parts of the world. The quality of this heavy-weight mutton is much inferior to ours. The supply of light, prime mutton from other countries is, however, only limited. We must therefore concentrate on improving the breeding of our flocks, and endeavour to meet the requirements of Smithfield by shipping lighter-weight mutton."

INTERNAL PARASITES OF SHEEP.

LUNG-WORM AND STOMACH-WORM.

E. E. ELPHICK, M.R.C.V.S., Veterinarian, Hastings.

MOST farmers are acquainted with the troubles accompanying the infection of sheep with internal parasites, and many have experienced the difficulties to be met with in trying to remedy matters when once they have become firmly established. The trouble is not a new one; it has exercised the minds of flockowners for many years not only in New Zealand, but throughout the world. The diseases specially referred to here are those produced by the lung-worm (*Strongylus filaria*) and the stomach-worm (*Haemonchus contortus*). As these two affections are so often associated, and the methods of prevention, &c., are on similar lines, both will be dealt with together, after giving a short account of the parasites and the symptoms produced. I am convinced that they are the cause of more mortality in the flocks of this Dominion than all other factors put together. The main object of this article is to show that this annual loss is largely preventable, and that a saving of many thousands of pounds could be effected by following the lines suggested.

LUNG-WORM.

The location of this parasite is either in the bronchi or bronchioles of the lungs. The worm is white, with the dark line of the intestine showing along the full length. The male is shorter than the female, and has a caudal pouch; the female tail tapers to a point. The male is 1 in. to 3 in. and the female 2 in. to 4 in. long.

Life-history.—The eggs deposited by the female are hatched in the lung of the host, and are expelled during a paroxysm of coughing, or swallowed and passed in the fæces. The larvæ moult twice during the next few days (the time varies with temperature and moisture), and become infective within probably ten days. They climb up the grass-blades during wet and warm weather, are ingested by grazing sheep, and make their way to the lungs. Symptoms are shown in four to five weeks, when fresh embryos can be recovered from the droppings.

Symptoms.—These may be mentioned for the benefit of the uninitiated. It should be borne in mind that the severity of the attack is in direct proportion to the degree of infestation. The symptom first noticed is a husky cough, during which the animal arches its back in its endeavour to rid itself of the parasites. There is a frothy mucus coughed up, sometimes stained with blood. Death follows from weakness and suffocation. Frequently the stomach-worm is also present, in which case the condition is much aggravated.

Treatment.—Medicinal treatment has not proved very successful, and where large numbers of sheep are troubled it is almost impracticable. Intratracheal injections with various medicaments have been tried, as also treatment by fumigation and inhalations of chloroform. *Nursing* plays the most important part in treatment. Sheep should be removed from wet and low-lying pastures, and placed on the driest to be had, and fed small quantities of dry and nourishing feed two or three

times daily. Crushed oats are good, with the addition of chaff or sound hay. Rock salt should be available, and a plentiful supply of clean water.

Prevention.—This will be much on the same lines as that advocated for stomach-worm.

STOMACH-WORM.

This parasite is an inhabitant of the fourth stomach, and is from ½ in. to 1¼ in. in length. The female is the larger, and has a spiral striping. The eggs produced are voided in the droppings. Under suitable conditions of moisture and warmth they hatch in a few days, and within a fortnight develop into a stage possessing a cuticular sheath, in which state they are able to survive any natural outside condition, including freezing. In a wet paddock or after rain these embryos migrate up the stalks of grasses and are eaten by sheep, when they complete their development in three weeks, and begin to produce eggs to continue ground-contamination. The stomach-worm is found all over New Zealand, but its ravages are most noticeable where there is warmth and moisture, in low-lying undrained areas liable to floods, and particularly where overstocking has taken place. The damage is greatest among lambs and hoggets, whose bodies have less resistance and are more intolerant of injury than those of mature sheep. The system breaks down more quickly from parasitic injury and the poisoning from the secretions and excretions of the parasite. On high country, and where the run is large in area, the parasite has a struggle for existence and the mortality is almost negligible.

Symptoms and Lesions.—When in sufficient numbers the parasites produce anæmia and a general unthriftiness characterized by paleness of the mucous membranes and swellings under the jaw and abdomen. The condition is progressive, diarrhœa supervenes, followed by death. If an infected hogget is killed and the fourth stomach immediately opened the worms are seen (in bad cases) quite readily as a wriggling red mass. If the stomach-contents are emptied out some of the worms will be seen attached to the lining, and on this lining being washed countless punctures are to be seen, one worm making many holes as it moves from place to place.

Treatment.—The greatest factor in successful treatment is a supply of good and nutritious food during the period when treatment is being given, coupled with a change to clean and dry paddocks. In this connection an article by Dr. J. A. Gilruth in 1903, when Chief Veterinarian, may be quoted, as follows: "The great aim of sheepowners should be to prevent the onset of disease, and this can be best done by keeping the sheep in good heart and fettle during the winter months. The superiority of dietetic treatment was demonstrated in the experiments carried out at Moumahaki in the winter of 1895. A mob of seventy lambs in very bad condition and infected by parasites of many species were sent to Moumahaki. For the purpose of the experiment the lambs were divided into four batches. Three batches were put on grass, and each given systematic medicinal treatment. The fourth batch received no medicinal treatment, but were put on good food (young oats and rape), and were given in addition a ration of oats and chaff. The following were the results: Batch 1, intratracheal injections—four died,

and one slaughtered as hopeless; batch 2, dosed with Liq. Arsenicalis (Fowler's solution) — three died, and one slaughtered as hopeless; batch 3, dosed with turpentine and oil—four died; batch 4, good food, no medicinal treatment—no deaths; all improved rapidly."

A medicinal treatment which has proved satisfactory is the use of a 1-per-cent. solution of bluestone, 2 oz. to 3 oz., according to age. Only clear crystals should be used; 4 oz. is dissolved in a pint of boiling water, and water added to make 3 gallons. This will dose over 100 hoggets, allowing for 10 per cent. waste. Only porcelain or enamel ware should be used, as bluestone will corrode metal. This drench should be given after a twelve-hours fast, and the animals treated held in the yards for a few hours afterwards, their droppings being gathered together and burned. The dose should be repeated at intervals of about four weeks. This kills all the parasites, as all the infective stages are swallowed and killed by the monthly dose before they can become mature and lay eggs. No fresh larvæ are hatched out, and the existing ones are killed off.

Prevention.—In no disease is the proverb "Prevention is better than cure" better exemplified than in this one. It is the flockowner's duty to prevent it. When lambs or hoggets become unthrifty, action should be taken at once. Kill one of the animals and find out what the trouble is; do not wait till numbers are affected. The longer treatment is put off, the more difficult will it become and cure be more remote. Young animals are more susceptible than old ones; therefore the first thing is to see that lambs and apparently clean sheep are separated from affected ones, and not exposed to the risk of contact with their manure. The safest paddocks should be theirs. Sunny hill slopes are the best, as they are cleansed by the rains and do not hold the moisture. The largest mortality occurs on the smaller holding, and the greater the carrying-capacity the greater the danger. The large holder, as stated before, has little to fear, as he is usually in a position to supply a change on to clean pasture just as often as desired, and so escapes the risk of a serious infection. Even in his case, however, it is not desirable that he should allow his young stock to graze or drink on wet or swampy areas.

The danger to the smaller farmer is further increased by the fact that he cannot give the essential change, his infestation is much heavier, and his mortality-rate soars if he has not the food available to tide the sheep over this critical period. It is to the small holder that the suggestions offered in this paper are more particularly applicable. The water-supply should be from a reliable source; deep pools and running water are not dangerous, but the edges of shallow pools and marshy ground are to be avoided. Water from wells pumped into troughs is the most suitable.

Drainage is of the greatest importance, as land which is always moist provides the ideal condition for parasitic life. Drainage immediately reduces the number of parasites.

THE FOOD INFLUENCE.

In an American publication some years ago this factor was well expressed in the form of an alliteration: "Permanent Pastures Perpetuate Parasites"; and in an article which appeared in the *New*

South Wales Agricultural Gazette last year this food influence is further stressed as follows :—

It is doubtful if any single factor will do more to counteract internal parasites and their effect than good feeding. Not the quantity but the quality is the important item. Closely associated with this aspect is the best utilization of grazing-land. Undoubtedly, from the anti-parasitic point of view, the subdivision of paddocks is the best course, particularly if each subdivision can be spelled in turn. The longer the paddock can be kept free from stock, the fewer parasites will survive. It is becoming more and more essential to combine agriculture with grazing, and this combination can be made to play its part in lowering the number of parasites. Supposing a cereal crop to have been harvested and wormy sheep to have been put on to eat the stubble and weeds: the sheep will deposit large numbers of eggs on the ground, but it will be ten to fourteen days before any of these eggs will become sufficiently developed to reinfest the sheep. If the sheep are removed and the paddock ploughed the embryos will be turned in and destroyed. Occasionally useful work can be done by burning off paddocks, large numbers of embryos being destroyed. All the measures suggested may not be applicable to all cases, but some at least can be utilized everywhere, and by their adoption and concerted action among stockowners the loss caused by the parasites could be greatly minimized. With closer settlement these methods of prevention will be capable of more general application, and it should be possible to look forward to better control in the future.

ECONOMIC SIGNIFICANCE IN NEW ZEALAND.

In the past practically no records have been kept of the mortality due to these parasites. This year, however, we have been able to get some figures from the Stock Inspectors throughout the country, and these are here tabulated. The figures can only be approximate, and while in some cases they may appear to be overestimated, in others they may be underestimated. The total numbers of sheep and lambs given in the table, and the figures on the next page, are compiled from the sheep returns and agricultural and pastoral statistics of 1924.

Estimated Losses of Sheep and Lambs from Parasitic Worms, Season 1924–25.

District.	Total Numbers (January, 1924, Enumeration).		Losses.			
			Sheep.		Lambs.	
	Sheep.	Lambs.	Number.	Percentage.	Number.	Percentage.
Wellington ..	4,000,000	1,333,000	68,000	1·7	50,654	3·7
Nelson ..	298,000	100,000	5,960	2·0	9,000	9·0
Marlborough ..	743,000	248,000	3,715	0·5	2,480	1·0
Gisborne ..	2,271,000	757,000	31,794	1·4	19,682	2·6
Hawke's Bay ..	2,191,000	730,000	39,438	1·8	18,250	2·5
Taranaki ..	568,000	189,000	2,272	0·4	3,770	2·0
Auckland ..	1,140,000	380,000	28,500	2·5	3,800	10·0
Otago ..	2,143,000	714,000	23,573	1·1	7,854	1·1
Canterbury and Westland	3,340,000	1,113,000	13,360	0·4	15,582	1·4
Southland ..	1,092,000	364,000	4,368	0·4	6,552	1·4
Dominion ..	17,786,000	5,928,000	220,979	1·2	171,824	2·9

Total season's loss of sheep and lambs, 392,803.

NOTE.—The districts specified are those of the corresponding stock inspectorates: Gisborne, for instance, includes the East Cape country round to the Bay of Plenty, while Nelson comprises Collingwood County and parts of Buller County, with areas of low-lying coastal lands.

At 31st January, 1924, there were returned 21,077,684 sheep shorn and 11,133,336 lambs tailed, a total of 32,211,020. At 30th April the total was 23,775,776 sheep and lambs, a decrease of 8,435,244. This is accounted for by slaughter for export, local consumption, weather, &c. Assessing the reduction in lambs from these causes at (in round figures) 5,000,000, and sheep at 3,500,000, we should have, roughly, 18,000,000 sheep and 6,000,000 lambs, being a proportion of three sheep to each lamb. It is from about this period (March–April) onwards that the biggest losses occur from parasitic infection, and my calculations in the foregoing table are based on the figures of sheep and lambs just stated. The table covers one season only, and information collected over a number of years would, of course, be required to establish definite data, as mortality varies from season to season, according to weather conditions, &c. The seriousness of the losses, however, is clearly indicated.

CONCLUSION.

The more important points in the preventive control of these internal parasites may be stressed once again—namely, a clean water-supply; drainage of swampy land; and pasture rotation, with the use of forage crops. Liming, and the ploughing and renewal of inferior sheep-sick grassland, have worked wonders in many cases.

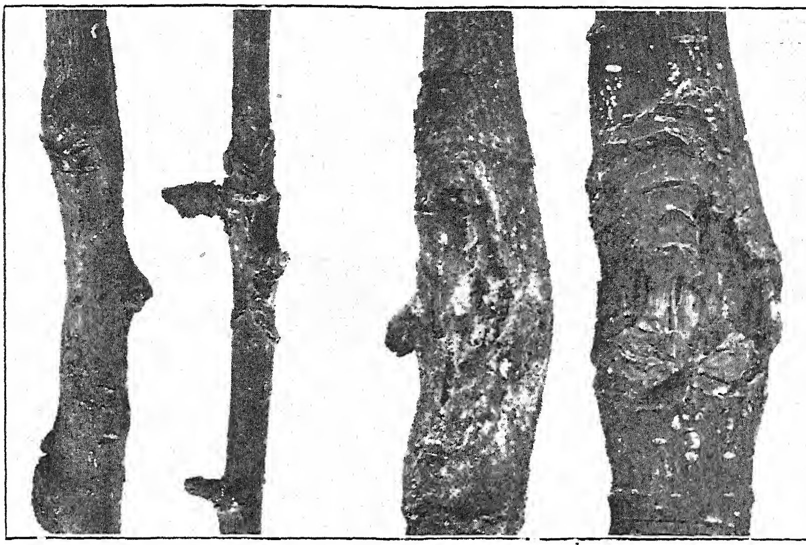
INCIDENCE OF APPLE-CANKER (NECTRIA GALLIGENA BRES.) IN NEW ZEALAND.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

RECENTLY in "Fungous Diseases of Fruit Trees in New Zealand," p. 107, the writer stated that apple-canker was not present in the Dominion, despite the fact that it had previously been recorded by Kirk (*N.Z. Dept. Agr. 13th Ann. Rept.*, p. 412, 1905). This conclusion was arrived at after the examination of approximately 1,500 specimens of cankered apple-branches forwarded to this Laboratory during the past six years by Orchard Instructors and orchardists. These cankers were found to be invariably due to black-rot, fireblight, diplodia-canker, and (rarely) bitter-rot.

Recently, however, specimens of apple-branches were received from Mr. P. Everett, Orchard Instructor, Whangarei, affected with a canker which on close examination was found to differ from black-rot canker, which it somewhat closely resembled. Microscopic examination revealed the presence of both conidia and perithecia of the fungus *Nectria galligena* Bres. These structures were compared with those present on apple-shoots infected with this fungus forwarded by Mr. P. Wiltshire, Imperial Bureau of Mycology, Kew, England, and were found to be identical.

Mr. Everett stated that these cankered specimens were obtained from one orchard, to which the disease appeared to be confined, in the vicinity of Kokako, Whangarei. Owing to its apparent rarity, the writer has not considered it necessary to give details of the life-history of the causal organism, but notes as to the appearance of the



APPLE-CANKER ; NATURAL SIZE.

(*a*) Young cankers ; one on right-hand twig showing conidial pustules. (*b*) Old cankers, showing distortion of branch and exposure of wood ; perithecia are present on right hand specimen. [*Photos by H. Drake.*

cankers induced by the disease are given to assist diagnosis, so that the extent of the area of infection may be ascertained.

While the cankers resemble closely those due to black-rot, they differ in several details. Young cankers are pallid brown, sunken, and somewhat flattened or distorted, and are delimited by a crevice. The surface is usually studded with small, erumpent, pallid pink or cream, conidial pustules, which give to the whole surface a roughened appearance. As the canker ages, the surface becomes broken up by the appearance of numerous concentric crevices, the disease at this stage closely resembling black-rot, but being separated by the conidial pustules which now appear in the crevices. On a few cankers perithecia are present, appearing as reddish, globose bodies, superficially resembling red-mite eggs.

Thus the non-zoned appearance and presence of conidial pustules separate the young cankers from those due to black-rot, and separation at a later stage may be effected by the presence of conidial pustules (and occasionally perithecia) in the crevices. The distorting habit is also a character by which separation may be effected, but is not infallible in that many cankers do not exhibit this condition.

From old cankers the dead bark frequently flakes away, leaving exposed the underlying dead wood, in this respect differing from black-rot cankers, on which the dead bark usually persists.

Remedial treatment would lie in the direction of prevention of further infection by removal of sources of infection, for this disease cannot be held in check by spraying. Therefore all cankered branches should be removed by cutting several inches below the point of visible infection. The wounds should then be dressed with coal-tar. All cankered wood should be burned and not allowed to lie on the ground.

THE MOWING OF PASTURES AND MANIPULATION OF THE GRASS-MOWER.

P. W. SMALLFIELD, B.Ag. (N.Z.), Instructor in Agriculture, Ruakura Farm of Instruction.

SUCCESSFUL dairy-farming in New Zealand depends very largely on the economical management of permanent-grass land. The aim of the farmer should be to maintain his pastures in such a condition that they throw an abundance of short succulent feed for as long a period as possible. Top-dressing, chain-harrowing, regulation of stocking, subdivision, and the feeding-out of roots and hay on pastures are all excellent management methods for keeping pastures in the best possible condition for milk-production. There is perhaps no means at the disposal of the dairy-farmer for improving his pastures so easy, cheap, and effective as the practice of summer mowing.

PRINCIPLES OF SUMMER MOWING.

In normal seasons most dairying pastures become rank in the summer, and this rank growth is, of course, due to the fact that an average permanent pasture makes about 75 per cent. of its total annual production during the late spring and early summer months. On most intensive dairy farms the farm is usually understocked in the summer-time, and even shutting up a field or so for hay does not allow of sufficiently heavy stocking to keep the rest of the pastures down. It is only on dairy farms of the more extensive type, where the herd is wintered off the dairying pastures, that the summer stocking can be regulated to make the full use of the summer production of grass.

Grasses when they get rank and mature are not as valuable for milk-production as when they are young and the growth short. In other words, the nutritive ratio of the grass widens when the growth gets rank, and from a nutritive ratio of 1 : 5 or 1 : 6 when young they pass to a nutritive ratio of 1 : 9 or 1 : 10 when mature. Cows will produce milk most economically when fed a ration having a ratio of about 1 : 6—that is, the food contains one part of protein to six parts of carbohydrates. It may often be observed in wet summers that the milk-yield falls in January while there is still abundant rank feed in the dairying pastures. The reason for this is that the cows neglect the rank growth, which they seem to know instinctively is unsuitable for them to produce milk on, and continuously graze the patches of grass which they have kept down. So that actually the cows are not getting sufficient food while there appears to be abundant food in the pasture.

A rank growth of grass left on the pasture has a very deleterious effect on the grass sward. Cocksfoot gets very tufted, white clover becomes stunted, and the turf opens up, leaving bare spaces. Perhaps the most detrimental effect of rank-pasture growth is the checking of the white-clover growth, as this is the important element of a pasture which forms the bottom to the sward, keeps the surface of the ground moist, and protects the shallow-rooted grasses. Summer mowing before the rank growth of grass has choked the white clover causes a remark-

able growth of the latter during the autumn. This effect of mowing on white clover can often be seen on lawns ; if a section of grass round a house is allowed to grow rank it often assumes a pure cocksfoot stand, whereas on mowing the grass and keeping it close with a lawn-mower the sward often changes to one of almost pure white clover.

HAYING AND MOWING FOR ENSILAGE.

Many of the bad effects of allowing a rank growth to persist in a pasture can be seen in a field that is shut up and hayed in December or January ; the rank growth in the summer chokes the white clover, and the aftermath in the autumn usually consists of cocksfoot, the poor growth of white clover being often most marked. In certain respects it would perhaps be better if hay could be saved from special hay crops and not from the average dairying pasture. This is not at all feasible under the present systems of farm-management, but the effect of late haying on a pasture should be recognized, and attempts made to bring back the pasture sward by top-dressing, chain-harrowing, and the feeding-out of roots and hay.

Saving pasture grass for silage aims at cutting a shut-up field in November while the clover-growth is still vigorous and when there are still good prospects of rain falling so that the field will throw good succulent autumn feed. An early-mown pasture usually throws good autumn feed of grass, and the white-clover growth is often most marked.

SUMMER MOWING OF RANK GROWTH.

It is the summer mowing of the rank growth in the dairying pastures from November to February that offers the best opportunity to the average dairy-farmer to improve his pastures. During this period of the year practically all pastures show an uneven, rank growth. Perhaps the best way to commence mowing this growth is to turn into the field all the dry stock on the farm—yearling heifers and the bull. On the first day a quarter or a third of the field should be mown. The stock will eat up all the cut herbage immediately it has wilted. When they have cleaned up most of the cut material another section can be mown, and this be continued till the field is finished.

MANIPULATION OF THE MOWER.

Many mowers on farms are badly neglected, and after a few years' work cut very badly. In many cases the machine is allowed to get out of adjustment through lack of appreciation of the principles on which a grass-mower works. Many people are under the impression that the knife does all the cutting, and confine their attention to the grinding of the knife. In such case, to enable the knife to cut when the other parts of the mechanism are out of adjustment, it is necessary that the horses be worked at a very rapid pace, which is both tiring to the horses and the driver.

Cutting-mechanism.—The cutting of the grass is performed by the blade section and the ledger-plate of the finger-bar, which act as a pair of shears. The finger-bars divide the grass into bunches, and the knife section moving from the centre of one finger to the centre of the next one presses the bunches of grass against the ledger-plates of the finger-bars ; the knife section in sliding over the ledger-plate cuts the bunch

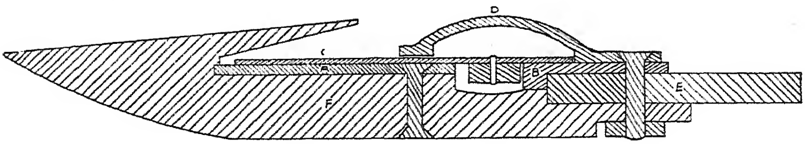


DIAGRAM OF CROSS-SECTION OF FINGER AND KNIFE BAR IN GRASS MOWER.

(*a*) Ledger-plate ; (*b*) wearing-plate ; (*c*) knife section ; (*d*) cap ; (*e*) knife-bar ; (*f*) finger.

of grass from the rear forwards. For efficient cutting it is obvious that both the edges—the ledger-plate and the knife section—must be both sharp and in close contact. As stated, it is usual to keep the knife sections sharp, but little attention is often given to the edges of the ledger-plates. After a time the edges of these plates become dull and worn. Before putting a mower away the ledger-plates should be greased to prevent them rusting. If the plates are badly worn they should be renewed. Some mowers are provided with fingers having detachable plates ; in other machines where the plate is welded in a new finger is required when the edge of the plate becomes worn. The best sharpener for the knife sections is a grindstone, using plenty of water to keep the knife cool.

Lack of contact between the knife section and the ledger-plates is a common source of bad cutting. The same thing is sometimes seen in a shearing-machine hand-piece, where, unless the comb and cutter are brought in close contact, the shears will not cut. Lack of contact between the knife sections and the ledger-plate in a mower is usually due to some of the plates being worn and new plates on some of the fingers raising the knife off the worn ones. When putting on new fingers thin washers are often required to bring them into alignment with the old ones. Sometimes lack of contact is due to the cutter-bar sagging in the middle. The knife is kept from lifting by means of caps ; these caps, however, should not be in contact with the knife, but just allow the knife free movement.

Centering.—When the knife is at the end of its outwards or inwards stroke the knife sections should lie in the centre of the fingers ; if the sections do not centre the cut is ragged and the draught increased. This defect is usually due to the pitman not being of the correct length. Most metal pitmans allow of adjustment. Another cause of this defect is that the bar is out of alignment, which may have been caused by bending after striking some object, or from continuously cutting round corners. Besides causing bad cutting, a disaligned bar causes severe wear on the knife-head.

Lubrication.—A mowing-machine should receive the careful attention that is due to any valuable machinery. It is fairly easy to keep a machine in good order, but often extremely difficult to set an old machine that has been neglected. Fast-moving parts require plenty of lubrication : the two ends of the pitman should be oiled every few rounds, the gears every half-hour, and the rest of the bearings every yoking-up.

The writer desires to state that his experience of the beneficial effects of summer mowing has been obtained at Ruakura Farm of Instruction, where the practice was commenced a number of years ago by Mr. A. W. Green.

LIMING AND TOP-DRESSING AT WINTON EXPERIMENTAL AREA.

BOTANICAL ANALYSIS OF PASTURE.

R. McGILLIVRAY, F.L.S., Fields Division, Invercargill.

BLOCK 3 of the Winton Experimental Area, on which the investigation here recorded was carried out, was sown in temporary pasture in 1920, the seeding consisting of 40 lb. perennial rye-grass, 6 lb. Italian rye-grass, 2 lb. white clover, and 3 lb. red clover. The block—an area of 5 acres—had been limed as shown in the accompanying plan. In

	1·8 Tons Carbonate of Lime. A.	3·6 Tons Carbonate of Lime. B.	No Lime. C.	2 Tons Burnt Lime. D.	1 Ton Burnt Lime. E.	Totals.	
Plot 1 ..	152	152	128	184	136	752	Basic slag.
Plot 2 ..	140	144	112	152	128	676	Control.
Plot 3 ..	164	208	124	196	136	828	Basic slag.
Plot 4 ..	144	176	128	152	128	728	Control.
Plot 5 ..	176	188	132	160	132	788	Basic slag.
Plot 6 ..	143	144	128	148	128	691	Nauru rock phosphate.
Plot 7 ..	152	160	144	152	128	736	Control.
Plot 8 ..	132	144	128	148	104	656	Nauru rock phosphate.
Plot 9 ..	156	148	128	148	112	692	Control.
Plot 10 ..	120	144	144	128	104	640	Nauru rock phosphate.

LAY-OUT OF BLOCK 3, WINTON EXPERIMENTAL AREA, FOR LIMING AND TOP-DRESSING EXPERIMENT AND BOTANICAL INVESTIGATION OF PASTURE (DIAGRAMMATIC).

The figures given on the plots represent green weights of herbage in ounces.

July, 1924, basic slag and Nauru ground rock phosphate, at the rate of 3 cwt. per acre, were applied, according to a scheme also shown on the plan. The block was heavily grazed with sheep until 2nd November, when it was closed up for the purpose of investigating the action of the fertilizers and also the botanical composition of the pasture.

MANURIAL RESULTS.

On 26th November an area on each subdivision, commencing at 1A and finishing at 1E, was cut—following on with each plot in a similar way until the final area 10E was completed. The method adopted was to cut an area and weigh a length of 16½ ft. by 4 ft. wide, commencing at Plot 1A. The cutting was performed with a two-horse mower, and was carried to completion under ideal conditions. Green weights were taken in all cases within five minutes after the pasturage was cut. From each weighing a representative sample was taken, each of which was of exactly the same weight. The samples were placed in calico bags and removed to Invercargill, where the contents of each were spread out and air-dried prior to dry-weight determinations and a botanical analysis being undertaken. In the case of dry weights of samples no great variation was found except on the no-lime subdivisions. The loss of weight on all limed and phosphated plots was found to amount on an average to 74 per cent. On Plots 2, 4, 7, and 9, however, where no phosphates had been applied, the loss of weight ranged from 76 to approximately 80 per cent. Subdivisions 2C, 4C, 7C, and 9C all showed a loss of weight slightly in excess of 80 per cent. The basic slag plots proved to have a greater clover content than the Nauru phosphate plots. The latter, however, proved superior in this respect to the controls. One remarkable feature of the analysis of the vegetation was the small weed content of the pasture. In one subdivision only did the weed population amount to over 7 per cent., whereas in quite good pastures weeds of various kinds are often found to amount to 25 per cent. of the total.

It should be mentioned that subdivision E showed the effect of a rather lengthy period of dry weather more than any of the other parts of the field. This somewhat reduced the weights per subdivision, but from a botanical point of view subdivision E was very similar to the others. If the area had not been so heavily grazed up till about three weeks before the investigation was made it is certain the clover percentage in the botanical analysis would have been higher; and results would also have been somewhat different if the examination had been of a permanent-pasture block which had received a seeding of a diversified nature, instead of a temporary pasture with a restricted seeding.

The following table gives a clear indication of average green weights of the manured and control subdivisions under the various dressings of lime :—

			Oz.
Subdivision	A :	1·8 tons carbonate of lime, plus basic slag (3 cwt.)	164
,,	B :	3·6 tons carbonate of lime, plus basic slag (3 cwt.)	182
,,	C :	No lime ; basic slag (3 cwt.)	128
,,	D :	2 tons burnt lime, plus basic slag (3 cwt.)	180
,,	E :	1 ton burnt lime, plus basic slag (3 cwt.)	134
Subdivision	A :	1·8 tons carbonate of lime, plus Nauru phosphate (3 cwt.)	131·6
,,	B :	3·6 tons carbonate of lime, plus Nauru phosphate (3 cwt.)	144
,,	C :	No lime ; Nauru phosphate (3 cwt.)	133·3
,,	D :	2 tons burnt lime, plus Nauru phosphate (3 cwt.)	141·3
,,	E :	1 ton burnt lime, plus Nauru phosphate (3 cwt.)	112
Subdivision	A :	1·8 tons carbonate of lime—control	148
,	B :	3·8 tons carbonate of lime—control	157
,,	C :	No lime—control	128
,,	D :	2 tons burnt lime—control	151
,,	E :	1 ton burnt lime—control	124

The weights per plot under the manurial scheme are given in the following table :—

	Oz.	Average per Plot. Oz.
Basic slag (totals)—		
Plot 1	752	789
Plot 3	828	
Plot 5	788	
Nauru phosphate (totals)—		
Plot 6	691	662
Plot 8	656	
Plot 10	640	
Control plots (totals)—		
Plot 2	676	708
Plot 4	728	
Plot 7	736	
Plot 9	692	

The results revealed are of considerable interest. Basic slag in this investigation stands far ahead of Nauru rock phosphate. If the three slag plots are taken we get a total of 2,368 oz., while the three Nauru plots only gave a return of 1,987 oz. This difference translated into acre proportions amounts to large dimensions. It will be noticed also in the case of the Nauru plots that the immediate controls show a heavier weight than any of the dressed plots. The average weight in the slag plots was 789·3 oz. ; Nauru rock phosphate, 662·6 oz. ; and controls, 708 oz.

It will also be noticed in this connection that subdivision E showed up rather indifferently. The explanation is that the whole of this subdivision was in a drier condition than that of the remainder of the block, and thus although growth was not so prolific it was very even throughout.

BOTANICAL ANALYSIS.

The results of the botanical analysis of the block—based on weights—are shown in the following table, which should be read in connection with the plan :—

	Grasses.	Clovers.	Other Plants (Weeds).		Grasses.	Clovers.	Other Plants (Weeds).
Plot 1.	Per Cent.	Per Cent.	Per Cent.	Plot 4.	Per Cent.	Per Cent.	Per Cent
A ..	82·60	10·80	6·60	A ..	86·25	8·25	5·50
B ..	82·00	12·10	5·90	B ..	85·65	8·95	5·40
C ..	85·60	8·00	6·40	C ..	87·00	7·00	6·00
D ..	83·20	11·80	5·00	D ..	85·90	8·98	5·12
E ..	83·25	11·00	5·75	E ..	85·86	8·48	5·66
Plot 2.				Plot 5.			
A ..	87·00	8·00	5·00	A ..	84·04	10·60	5·36
B ..	86·20	8·85	4·95	B ..	83·80	11·49	4·71
C ..	87·10	6·28	6·62	C ..	85·00	8·15	6·85
D ..	85·80	9·00	5·20	D ..	83·00	10·86	6·14
E ..	86·20	7·95	5·85	E ..	83·90	10·05	6·05
Plot 3.				Plot 6.			
A ..	83·45	9·92	6·63	A ..	85·20	10·00	4·80
B ..	83·00	11·86	5·14	B ..	84·76	11·00	4·14
C ..	85·05	8·85	7·10	C ..	86·00	8·04	5·86
D ..	83·45	11·10	5·45	D ..	84·10	9·86	6·04
E ..	85·00	11·10	4·90	E ..	84·98	9·82	5·20

BOTANICAL ANALYSIS—*continued.*

		Grasses.	Clovers.	Other Plants (Weeds).
		Per Cent.	Per Cent.	Per Cent.
Plot 7.				
A	..	85·80	8·00	6·20
B	..	85·00	9·10	5·90
C	..	86·25	6·90	6·85
D	..	85·90	8·40	5·70
E	..	85·15	8·40	6·45
Plot 8.				
A	..	86·20	9·55	4·25
B	..	86·00	10·95	3·05
C	..	86·60	7·80	5·60
D	..	85·00	9·10	5·90
E	..	86·00	9·20	4·80
Plot 9.				
A	..	86·60	7·95	5·35
B	..	86·00	9·60	4·40
C	..	86·95	7·00	6·05
D	..	86·00	8·20	5·80
E	..	86·60	8·10	5·30
Plot 10.				
A	..	86·65	7·95	5·40
B	..	86·25	8·88	4·87
C	..	86·95	6·94	6·11
D	..	86·00	8·66	5·34
E	..	86·16	8·42	5·42

The weed-plants present in the pasture were curled dock, hedge-mustard, sorrel, sow-thistle, chickweed, catsear, scarlet pimpernel, persicaria, Scotch thistle, and self-heal.

VARIATIONS IN THE PERCENTAGE OF BUTTER-FAT IN MILK.

(Concluded.)

V. SUMMARY OF THE INVESTIGATION.

W. N. PATON, Dairy Division, Wellington.

CONCLUDING this investigation, it is patent that the percentage of butterfat in milk is a complexly variable quantity, subject to influence by quite a number of factors. In some instances these causal factors are interdependent, and thus make it difficult to isolate the effects of any particular one. It is not always possible, therefore, to eliminate the probable effects of such extraneous factors, and for this reason some results have superimposed upon them the combined effects of other factors. Moreover, on many points of interest cow-testing data do not supply particulars, and thus are limited in application for purposes of investigating all phases of test fluctuation. To fully cover all features an investigation of this nature obviously requires to be supplemented by specially controlled experiments. Notwithstanding these limitations, results of a very useful nature have been obtained. Exceptions are due in the most part to peculiarities of the individual; and, since indiv duality within a breed is responsible for more variability than that of breed tself, it is little to be wondered at that they have been met with. The underlying principles which govern test variation are best represented in average or normal cases. The conclusions, therefore, have been deduced as much as possible from this basis, and, although not invariable, represent general tendencies which naturally are of greatest importance.

Test variations have been summarized under three main headings—namely, daily, monthly, and yearly. The operating factors responsible for the variations are enumerated under the respective headings.

DAILY VARIATIONS.

No C.O.R. data were available for investigating this phase of test variations, and the second article of the series was more of a precis of the findings of many investigations. No acknowledgments of the various sources of information were made, since the number of references would necessarily have been very numerous. However, the writer would here express his thanks to the many investigators to whose works he made reference. As a summary of this phase of test variations the position could not be better stated than by adopting the conclusions given in Article II :—

(1.) Provided that milking in every case is complete and that the variations in milk-yield are not of an extreme nature (otherwise the rule may or may not apply), the daily test varies inversely, to a certain extent, with the milk-yield.

(2.) Whenever the daily test is influenced by any means it soon tends back to normal, and usually in so doing swings slightly past normal in the other direction before finally coming to rest.

(3.) Where cows receive good feeding and attention the test cannot be permanently raised by any app:eciable amount by the use of special foods.

MONTHLY VARIATIONS (C.O.R. DATA).

Breed: Red Poll, Ayrshire, Milking Shorthorn, and Friesian monthly tests, in average cases, decrease for a few months after calving, and then increase gradually to the end of the lactation period, the final test being about 20 per cent. higher than the first. On the average, Jersey monthly tests increase right throughout a lactation and finish at about 35 per cent. more than the first test. The range in variation between the lowest and highest monthly tests of the other breeds amounts to about 25 per cent. of the annual test.

Time of year of calving: The first and final monthly tests are generally highest for cows commencing their lactation period in late autumn or winter, and lowest for those calving in late spring or summer. Furthermore, cows test highest and lowest respectively during these periods irrespective of the month of commencement. The percentage range of variation between tests for the two periods lies roughly between the limits of 5 per cent. and 10 per cent.

Length of period of gestation during lactation: The longer a cow is non-pregnant during a lactation period the lower are the final monthly tests; the lowering of the final tests ceases for longer fallow periods than about seven months and a half, the final test being then nearly as low as the first. In other words, a cow may be pregnant up to about four months and a half during a 365-day lactation without this affecting the monthly tests or their trend of variation.

Nature of season: The general rule is that the monthly tests are slightly lower than the average following wet periods, and slightly higher following dry ones, the percentage variation from the average being rarely more than 5 per cent. for any one month or 2 per cent. for all months.

Age: The general trend of monthly tests for varying ages remains uniform, the various curves being above, below, or coincident with the average curve for all ages.

Quantity of milk-production: Difference in quantity of annual milk-production seldom affects the general trend of monthly tests, but where individual monthly milk-yields vary much from the average the tests vary inversely. (Note: For entirely pasture-fed cows rainfall is the principal cause of variation in monthly milk-yield.)

YEARLY VARIATIONS (C.O.R. DATA).

Breed: To illustrate the range in variation in test due to breed, the average tests for the various breeds reduced to percentages of the average Jersey test are as follows: Red Poll, 79 per cent.; Ayrshire, 74 per cent.; Milking Shorthorn, 72 per cent.; Friesian, 64 per cent. The maximum range of variation in test within each breed is approximately 60 per cent., whereas that in annual milk-yield is about two and a half times this amount.

Time of year of calving: The annual tests are highest for cows calving in late autumn or winter, and lowest for cows calving in late spring or summer, the percentage difference in average cases ranging up to about 5 per cent.

Length of period of gestation during lactation: The longer a cow is non-pregnant during a lactation period the lower the annual test, the annual test reaching a minimum for a fallow period of about seven months and a half or more following freshening. In other words, a cow may be pregnant up to about four months and a half during a 365-day lactation without the annual test being influenced in any way. On an average, the range in variation between the extremes is in the region of 5 per cent. The extremes are: (1) Cows pregnant immediately following freshening—in which case the lactation period is nine to ten months only; (2) cows conceiving seven months and a half or more after commencement of a lactation.

Nature of season: The annual test is lowered slightly for a wet season, and raised slightly for a dry one, the percentage variation from the average being rarely more than 2 per cent.

Age: As age advances after first calving the annual test decreases gradually by small amounts for about ten lactations, and then appears to rise somewhat, the total range in variation being roughly 6 per cent.

Quantity of milk-production: The test varies inversely to a slight extent with the milk-production, being more noticeable when the latter varies below than when it varies above. The rate of variation in test is not constant, and increases toward the milk-yield extremes, especially toward the lower one. The range in test variation for extremes of milk-yield variation amounts to something like 20 per cent. The range of variation for normal cases is, however, considerably less than this amount. A rough rule is that the test varies inversely with quantity of milk-production in the ratio of 1 : 8; for example, if the quantity of milk is 8 per cent. above the mean the test will be 1 per cent. below the mean, and *vice versa*.

PRACTICAL APPLICATION.

For the purposes of practical application the results of this investigation have been linked with a few suggestions. These are given under three headings, according as they interest different sections of the dairying community.

Points for Suppliers of Dairy Factories.

The main object of the supplier of milk to dairy factories is to obtain as much butterfat as possible from each cow. To fully achieve this objective the cow must be 100 per cent. efficient—that is, she should be producing butterfat to the full extent of her capacity. In other words, a cow should be handled in such a manner that the highest possible quantity and quality of milk are obtained at all times. The following hints should be helpful in attaining the latter object at least :—

(1.) The operation of milking should be skilful, fast, and, above all, complete. This ensures both a richer and greater quantity of milk being given.

(2.) A cow should be " brought in " in good condition, and so maintained as much as possible throughout the whole lactation period.

(3.) From the point of view of butterfat-production the best time of freshening is autumn or early winter. Not only is a higher annual test obtained, but also a longer lactation period, this tendency to milk longer being greatest for cows commenced in June or July. According to an American investigation, this period of commencement also gives a higher income over cost of feed (United States Department of Agriculture Bulletin No. 1071). This finding might or might not exactly coincide with results of a similar investigation here, since winter feeding there has to be specially provided for to a much greater extent than in New Zealand. The owner would require to decide whether advantage gained in butterfat-production by autumn or early winter calving warranted the extra costs for feed, attention, &c.

(4.) The lactation period should be maintained as long as possible during the year, provided such is consistent with profitable butterfat-production. The efficiency of the cow as a butterfat-producer varies during a lactation, and the period should be terminated (with the possible exception of two-year-olds) as soon as economical production is no longer possible.

(5.) A cow should be treated kindly, be fed and milked at regular hours, have plenty of clean water, be protected from extremes of weather, have exercise and fresh air, and be kept as far as practicable from all forms of excitement, injury, and sickness.

For Dairymen supplying Milk for Human Consumption.

Dairymen who supply milk for human consumption aim to obtain as much milk as possible from their cows, and at the same time during the whole season keep the percentage butterfat content of the herd milk above the minimum required by law. To conform to the

latter requirement regular testing is essential, more especially if the breed used is a low-testing one. A product of more uniform quality may be obtained by having cows freshen at different periods of the year. Furthermore, this practice tends to keep the quantity of milk fairly constant throughout the year. To avoid variation in quality of milk where separate deliveries are made from each milking, morning and evening milkings should be made as far as practicable at equal intervals. Other more or less minor variations may be avoided by adhering to the general rules set out in the preceding paragraph. Maximum annual milk-production is obtained by commencing cows in autumn or early winter.

For the Breeder of Purebred Dairy Cattle.

The breeder of purebred dairy cattle is anxious to obtain good records for his stock. Not only should the butterfat-yield be high, but also it is a popular desire that the test should rank high for the breed in question. Quality of milk is recognized as a hereditable factor, and thus breeders are aiming by means of selection to fix high-testing ability. Although a cow may have inherited this characteristic, it will remain more or less of an unknown quantity in breeding unless it has been developed and ascertained to its full extent beforehand. To facilitate its full development the operation of milking should be skilful, fast, and absolutely complete. In addition, the cow should be "brought in" in good condition during late autumn or winter, and freshenings be at intervals of not more than twelve months. In order to ascertain the extent of high-testing ability present a cow should be tested as early as possible—preferably as a two-year-old—under the conditions outlined. Under these conditions a cow should test as high as she is capable of. The only reliable guide to the test in this case is the "annual test," or average test for the lactation period. This is ascertained by dividing 100 times the annual butterfat by the annual milk figures. Before fair selection is possible the records for all animals from which selection is being made should have been made under similar conditions.

Since quality varies inversely with quantity of milk-yield to appreciable amounts only when the quantity falls well below the average, quantity of milk-production could be aimed for conjointly with quality without the former object in any way defeating the latter. By adhering strictly to this system, coupled with suitable selection and line or occasional careful inbreeding, it should be possible to found, in the course of a few generations, a high-testing strain the majority of individuals of which are prepotent for this characteristic.

The Late Mr. A. J. Faulkner.—We note with great regret the recent death of Mr. A. J. Faulkner, of Muriwai, Poverty Bay. Mr. Faulkner was a very progressive farmer, and his fine property "Wairakaia" gave him good scope in both the pastoral and arable branches of agriculture. His various contributions to the *Journal* in past years were much appreciated for their practical value. Mr. Faulkner did much good helpful work in a quiet way, and his loss will be felt by many in the district, especially among the soldier settlers.

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, 1924–25 SEASON.

J. M. SMITH, H.D.A., Assistant Instructor in Agriculture, Wanganui.

IN common with the rest of the Wellington west coast, the Marton district experienced an exceptional season during 1924–25 as far as weather conditions were concerned. This applies more particularly to pastures and fodder crops, although the returns from grain crops, on comparing these with the previous year's results, show that this past season suited them well also. A fairly mild, dry winter was followed by a good spring, perhaps a little on the wet side early, but extremely dry towards November. The midsummer was one of the wettest experienced for a number of years, and this seriously interfered with harvesting generally. Genial weather was experienced during the autumn, the latter part of which, however, had more than its usual share of cold southerly snaps. Details of the rainfall are as follows :—

1924.	Inches.	Wet Days.	1925.	Inches.	Wet Days.
July	2·76	11	January	3·23	6
August	2·45	9	February	2·16	9
September	3·33	18	March	1·85	8
October	4·73	16	April	0·99	10
November	1·45	9	May	5·02	18
December	8·14	19	June	3·77	18

The total rainfall for the season was 39·88 in., with 151 wet days.

SCHEME OF WORK.

It was pointed out in last year's report (*Journal*, September, 1924) that a great deal of the cultivated land in the Area had been put down in pasture with a view to carrying out top-dressing trials, which phase of farming along this coast is becoming extremely important in view of the conditions which nearly always follow the breaking-up of the land for cropping—namely, the invasion of weeds (particularly Californian thistle) and various pests and diseases. The area under crop during the past season was greater than that of the previous season, as two of the older pasture-paddocks were ploughed up. One had outlived its usefulness, and the other had a heavy growth of clover, which was turned under for the purpose of building up the soil-fertility. The crops grown were as follows: Wheat, 14 acres; oats, 2¼ acres; barley, 4 acres; peas, 3¾ acres; tares, ½ acre; and fodder crops, 10 acres—a total of 34½ acres. The balance of the Area, with the exception of the lucerne and clover plots, was down in grass, of which 18 acres were under trial for top-dressing.

WHEAT VARIETIES.

A variety trial with wheat was conducted in Field 6, the varieties under test being Queen Fair, Queen Fan, Turretfield Eclipse, Jumbuck, and Zealand. The plots were each 1 acre in area. The wheat was pickled and sown on 10th October, seeding being at the

rate of 2½ bushels, and the manure used 2 cwt. superphosphate pei acre. During the growing-period it was noticed that the Zealand variety was a very strong stooler and gave every indication of being a good fodder wheat. The crops were harvested during February, the different varieties reaching maturity as tabulated.

Table 1.

Variety.	Date cut.	Yield per Acre.		Remarks.
		Bush.	lb.	
Queen Fair ..	17/2/25	42	50	A little rust; inclined to lodge; medium straw.
Jumbuck ..	6/2/25	41	58	No rust; stood well.
Queen Fan ..	17/2/25	41	42	Very little rust; inclined to lodge.
Turretfield Eclipse	9/2/25	38	21	Badly rusted; stood well; short straw.
Zealand ..	19/2/25	21	43	Badly rusted; badly down; fine straw.

Birds were very severe on Zealand even before the other varieties were cut, although Zealand was then still quite green.

A further 9 acres were put down in two varieties of wheat—5 acres of John Brown and 4 acres of Major. A manurial trial was carried out on this area between superphosphate and a proprietary grain manure. A strip was sown through the middle of each variety with grain manure, and the balance sown with superphosphate; hence each strip with grain manure was bounded by the same variety of seed, but sown with superphosphate. The seed was treated with formalin and sown at the rate of 2½ bushels per acre on 4th October. The manure in each instance was applied at the rate of 2 cwt. A storm on 17th December played havoc with the John Brown over both manurial plots, and great patches throughout the crop went down. Major, on the other hand, was not affected. The John Brown was cut on 31st January, and Major on 11th February. The plots threshed out as follows:—

Table 2.

Variety.	Manure.	Yield.		Remarks.
		Bush.	lb.	
John Brown ..	Superphosphate..	29	21	Badly down; a little rust.
,, ..	Grain manure ..	32	0	,, ,,
Major	Superphosphate..	38	24	Stood well; clean.
,, ...	Grain manure ..	38	3	,, ,,

BARLEY, PEAS, AND VETCHES FOR THRESHING; VARIOUS FODDER CROPS.

Black Skinless barley and Early Minto peas were both sown in the wettest paddock on the Area, and this, together with the late date at which they were sown and (especially in the case of the peas) the wet conditions at harvesting-time, reduced the yields considerably. The peas in particular were lying cut for nearly five weeks, during which time they were turned several times on account of the wet

weather. Half an acre of William Hurst peas and the same area of Moumahaki vetch were harvested late, and at time of writing are still in the stack.

Ten acres were put down in ten 1-acre plots of various fodder crops, but owing to late sowing, followed by dry conditions, the growth made by the various crops did not warrant the carrying-out of the tests, and the area was grazed off without any weights being taken.

FIG. 1. PLOUGHING UNDER HEAVY GROWTH OF CLOVER AND RYE-GRASS IN FIELD 8, MARTON EXPERIMENTAL AREA.

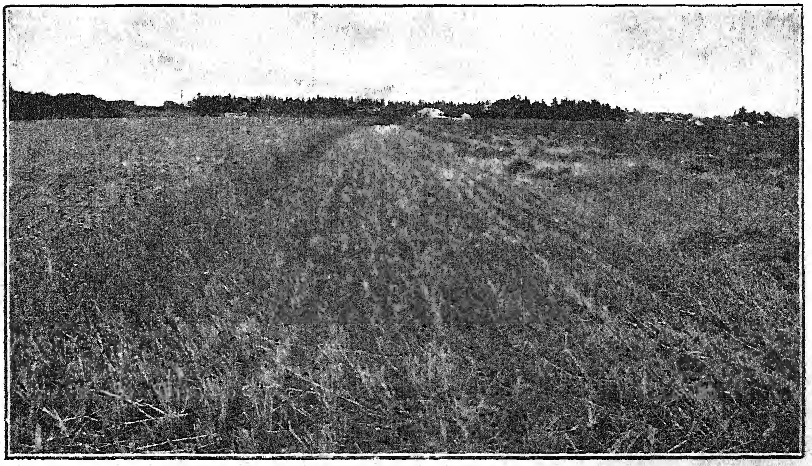


FIG. 2. BARLEY HARVEST IN FIELD 7 AT MARTON.

WILD WHITE CLOVER.

The imported wild white clover plot is now practically covered, and the clover has thoroughly established itself. It was not feasible to keep a separate tally of the stock this plot carried, but it was heavily stocked for fairly long periods at a time. In the autumn a seed crop was saved, but not without a great deal of trouble on account of the adverse weather conditions. A further half-acre of colonial white clover was sown on 5th December in close proximity to the wild white, and this has already established itself fairly well. During next season a comparison between the wild white and the colonial white will be made, when some interesting data should be forthcoming.

PASTURE TOP-DRESSING AND GRAZING TRIALS.

As mentioned previously, the pastures did remarkably well durir the past season. An instance of this is shown in Field 1, wh 11 acres of temporary pasture sown in April, 1921, and partially top-dressed in the winter of last year, carried just six sheep to the acre for the past twelve months—this, moreover, in addition to providing a hay crop. The top-dressing trial carried out on this area was one between the ordinary Nauru phosphate and a specially finely ground Nauru phosphate. The ordinary Nauru phosphate is fairly slow in its action, and it was thought that by grinding it up to an extremely fine powder it might become available to the plant much more quickly. Four and a half acres were pegged off in nine half-acre plots, each plot being 11 yards wide. The two different classes of Nauru were applied alternately to every other plot, the remaining plots being left as controls. Thus every manure plot had a control or untreated plot on either side of it. The manure was applied on 6th June, 1924, at the rate of 3 cwt. per acre. On 25th October the area was shut up for a hay crop, and this was cut and weighed on 8th December. Special precautions were taken in the cutting and weighing of the plots to ensure, as far as possible, that each plot should be weighed in sections immediately after the mower, to save any difference that might have occurred through evaporation. In compiling the results only neighbouring sections were compared, so that any difference due to soil-variation was eliminated as much as possible in the final results. The results were as follows, the average weights of green material from the various like plots being given :—

Table 3.

Manure.	Average Yield.	Average Yield of Controls.	Increase due to Manure.
	Tons cwt.	Tons cwt.	Cwt.
Ordinary Nauru phosphate ..	4 14	3 16	18
Special Nauru phosphate	4 6	3 18	8

The 13 acres of young temporary pasture carried 2·44 sheep per acre for the past season, in addition to providing two hay crops.

This meant that the nine months of grazing available did not include the period of greatest growth. The top-dressing trial with the two grades of Nauru was repeated on this area, the plots being treated in the same manner as described in connection with the previous area. The paddock was shut for a hay crop on 29th October, and the crop was cut and weighed on 1st December. There was a splendid aftermath of clover, and it was decided to take a second crop of hay. This was weighed on 29th January. The two crops resulted as follows, weights given being the average green weights from the various like plots :—

Table 4.

Manure.	First Crop.			Second Crop.		
	Average Yield.	Average Yield of Controls.	Increase due to Manure.	Average Yield.	Average Yield of Controls.	Increase due to Manure.
	Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.
Ordinary Nauru	9 16	9 0	0 16	8 5	7 3	1 2
Special Nauru ..	9 8	9 0	0 8	8 5	7 3	1 2

The small permanent pasture near the school was again top-dressed last year, and a hay crop taken off in December. The fertilizers applied and the green weights per acre are as shown in the following table :—

Table 5.

Plot.	Manure.	Date applied.	Hay-yield (Green Weight).
			Tons cwt.
1	Lime, 1 ton ; superphosphate, 2 cwt.	9/8/21	5 17
	,, ,, ...	11/8/24	
2	Bone-char, 4 cwt.	9/8/21	3 10
	Special Nauru, 4 cwt.	11/8/24	
3	Walpole guano, 4 cwt.	9/8/21	4 10
	Ordinary Nauru, 2 cwt.	11/8/24	
	Special Nauru, 2 cwt.	11/8/24	
4	Nauru, 4 cwt.	2/9/22	4 3
	,, ...	11/8/24	
5	Control (no manure)	..	2 1
6	Basic slag, 4 cwt.	14/7/21	4 7
	,, ...	11/8/24	
7	Nauru, 4 cwt.	14/7/21	3 19
	,, ...	11/8/24	
8	Ephos, 4 cwt.	14/7/21	3 17
	,, ...	11/8/24	

LUCERNE.

The lucerne stand gave three cuts during the season. This area is showing an inclination to go into grass, and will be limed and top-dressed in the spring with a view to increasing the amount of lucerne. Results for the past five seasons, in conjunction with the

various methods of sowing, are as follows (weights given being of green material) :—

Table 6.

Season.	Number of Cuts.	Broadcast.	7 in. Drills.	14 in. Drills.	21 in. Drills.
		Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.
1920–21	3	17 0	17 5	17 0	14 14
1921–22	4	25 10	19 14	22 12	21 8
1922–23	3	18 15	17 13	18 4	16 12
1923–24	3	15 15	14 17	14 4	13 6
1924–25	3	18 7	15 14	17 18	15 4
Average ..	..	19 1	17 0	17 19	16 5

GENERAL.

The carrying-capacity of the whole Experimental Area (including the pastures already mentioned) was just over two sheep to the acre for the season.

During the 1925–26 season a further area of unimproved adjoining land will be acquired, and this will be laid off in plots and top-dressed with various manures to ascertain what improvement can be made in the poor pasture already in existence, without breaking up the land. The top-dressing trials in operation will also be further carried on.

FARMERS' FIELD-CROP COMPETITIONS.

MAUKU AND PATUMAHOE DISTRICTS.

C. J. HAMBLYN, B.Ag. (N.Z.), Assistant Instructor in Agriculture, Auckland.

MANGOLDS have been grown successfully for many years in the Mauku and Patumahoe districts, but, although the soil and climatic conditions are fairly uniform, no uniformity exists among the farmers as to the varieties grown, the type and amount of fertilizer used, the time and method of planting, and so forth. With a view to fostering interest in mangold-growing, and, above all, gaining useful local information as to varieties, manures, &c., most suitable to the district, the Mauku Branch of the Farmers' Union this year organized a competition on the lines of the successful competitions held in the Taranaki, Wanganui, and Feilding districts.

The Branch has presented a handsome challenge cup, to be won outright by three wins in succession or five times at intervals, together with a gold medal to be retained by winners of the cup. The local agents of Messrs. Sutton and Sons have presented a gold medal for the grower of the best crop with Sutton's seed. The competition is for the best half-acre of mangolds of any variety grown by a farmer on his own property. Special forms are supplied on which the farmer is required to fill in details of cultivation, variety, amount of seed, manuring, method and time of planting, after-cultivation, &c.

The first competition was judged by the writer on 5th and 6th May last, and the cup and trophies were presented at a social gathering on 23rd June. A feature of the competition is that farmers are encouraged to accompany the judges round the various crops and enter freely into discussions of the merits and demerits of the crops under review. In this way much useful information is exchanged. Again, at the social gathering another opportunity is afforded the farmers of gaining further information, when the competition as a whole is discussed by the judge and comments passed on the crops in detail.

This season twenty entries were received, and of these thirteen were finally judged. In order to save time (only one judge being available), after a careful inspection of all the crops six outstanding crops were selected, and these were weighed and judged. For the purpose of gaining information as to the average weight of crops in the competition, and also the average of each variety grown, it is hoped to be able to weigh every crop next season. Altogether the competition has already proved a marked success, and it is to be hoped that other districts in the Auckland Province will take up the organization of similar field-crop competitions.

The heaviest crop in the Mauku competition this season was grown by Mr. J. Malcolmson. This was a good crop, the half-acre being made up of two-thirds of Jersey Queen and one-third Yellow Globe, averaging a yield of 54 tons per acre. The width between rows was 24 in.; manure, 10 cwt. mangold-fertilizer per acre. The second heaviest crop was one of Red Intermediate—53½ tons per acre—grown by Mr. A. Ashford; width between rows, 24 in.; manure, 7 cwt. per acre of mangold-fertilizer. The third heaviest crop, that of Messrs. Rowe Bros., yielded 51½ tons per acre; it was grown in 30 in. rows, with 15 cwt. of manure consisting of a mixture of kainit, superphosphate, and root manure in equal parts. This crop gained second place, being of much better quality and type than the heavier crop grown by Mr. Ashford.

All the crops judged were transplanted from special beds, or from a few rows in which all the seed was grown. This method allows, it is claimed, a free use of implements in the eradication of annual weeds before the crop is planted; and some very clean crops were seen on which no after-cultivation had been done, all the weeds having been got rid of previous to the transplanting. However, even where no weeds are present the necessity for after-cultivation is just as important as it is when the seed is drilled in the usual way.

Top-dressing of Sheep Pastures.—The third annual report of the New Zealand Meat Producers' Board remarks: "The great increase in the output of dairy-produce during the last ten years has been largely brought about by the top-dressing of pastures. The top-dressing of our sheep pastures will do the same for our meat and wool industry. A start has been made in some districts, with wonderfully good results. As much of our sheep-country is hilly and broken, top-dressing has to be done by hand, but experience has already proved that where the country is not too broken or inaccessible this can be done at moderate cost for labour."

SEASONAL NOTES.

THE FARM.

GRAIN CROPS.

SPRING-SOWN grain crops require a heavier seeding than those sown in autumn. Wheat and barley should be sown at about $2\frac{1}{2}$ bushels and oats 3 bushels to the acre. Where the area is small and birds are numerous these quantities can be increased by $\frac{1}{2}$ bushel per acre with safety. Great care should be taken not to spill any grain about the headlands, as this is a great attraction for birds. If they are troublesome it is a good plan to follow the drill and broadcast a little poisoned grain. Unless the land is very rich, all grain crops sown at this time of the year should have from 1 cwt. to 2 cwt. per acre of superphosphate or a similar amount of reliable grain manure. With the exception of very strong land the final feeding-off of autumn-sown crops should be completed during the coming month.

PEAS AND TARES FOR THRESHING.

Crops of peas and tares intended for threshing should be got in towards the end of September or early in October. Peas for lamb-fattening sown about the middle of October will be early enough in most situations. Peas should be sown at the rate of 3 bushels and tares $2\frac{1}{2}$ bushels per acre. Dairy-farmers with land available cannot do better than sow 2 or 3 acres of peas for pig-raising in the autumn and winter; there is no crop pigs will thrive on better. Both peas and tares are lime-loving plants, and, where at all possible, land intended for these crops should have a dressing of 5 cwt. to 10 cwt. of lime per acre. Basic super, basic slag, or super are suitable manures. Early Minto, Grey partridge, and Imperial blue do well generally. Early Minto is rather earlier than Grey partridge, and is the heavier yielder.

ROOT CROPS AND ROTATIONAL PRACTICE.

The preparation and cultivation of land for root crops should now be pushed along.

In many farms in Southland and south Otago it has become a common practice to grow two or more turnip or swede crops in succession. The fact should be emphasized that to crop in this manner is to court trouble, as club-root is becoming increasingly prevalent and becomes worse with each succeeding crop. At time of writing it would appear that quite a number of fields now in turnips in these districts will be sown in the same crop this season. The old practice in Southland was for oats to follow turnips, but this is not adhered to so generally now. Farmers would be well advised to grow a special hay crop, such as oats and peas, after turnips. A mixture of 2 bushels of oats and $1\frac{1}{2}$ bushels of partridge peas will give good results, especially if helped along with 2 cwt. of super per acre. The oats and peas for hay, if sown in September, would be ready to cut about the middle of January, and the land could then be turned over in readiness for an autumn crop.

LUCERNE.

Towards the end of September is generally a good time to clean up lucerne stands, either by cutting or by rapid grazing, so that a new crop will come away fresh and quickly. Where necessary, and where the land is dry enough, the period mentioned will also be a suitable one for giving the stand a spring cultivation, with the object of loosening the surface soil and letting the air in. If the conditions are unsuitable, however, it is much better to defer the cultivation until the next cut is removed. Generally speaking, a cultivator fitted with lucerne-teeth will be found the most suitable machine to use, but there are times when it is advisable to use the disk to cut the grass-sods into small pieces, and follow this with the cultivator or weighted tine harrows. When using the disk harrow the disks should be run nearly straight.

Stands that have not been top-dressed during the last year or two and are showing any signs of reduced yields may with advantage be top-dressed with 2 cwt. or 3 cwt. of super or basic super per acre. This will be especially beneficial if the land has been well limed during the winter.

Preparation of land intended for the establishment of lucerne should now be attended to. Where a cover-crop is available for green manure it should be turned under at once, so as to allow it plenty of time to become well rotted before the lucerne-seed is sown. If it is not possible to get the crop turned under by the end of September the better plan is to feed it off with stock and turn under the droppings. If the roots of recently germinated lucerne come in contact with half-decayed material they get burnt off, fail to penetrate the mass, and in consequence the stand is greatly checked and frequently ruined. Lea land and land that has just grown a crop should be ploughed deeply so as to smother as many weeds as possible, and the top 3 in. worked from time to time to germinate and destroy seedlings. Lime should be applied as soon after ploughing as possible, at the rate of 10 cwt. to 20 cwt. per acre.

GRASS PASTURES FOR HAY OR ENSILAGE.

Pastures intended for hay or ensilage should be well cleaned up during the coming month, so as to remove all old grass and give a clean bottom, with a view to shutting up about 1st October. Before being actually closed the pastures should be well harrowed with tripod and chain harrows, and if the land has not been recently top-dressed from 2 cwt. to 3 cwt. per acre of super or basic super may be applied with great advantage.

Particulars of special crops for hay and ensilage were given in last month's notes.

RENOVATION OF RATSTAIL GRASSLAND.

Large areas of coastal land and much of the soft hydraulic limestone country of Auckland Province originally sown in English grasses have, through neglect and bad management, reverted to an almost pure ratstail association. Much of this country is now being used for dairying, and for this purpose ratstail is entirely unsuited; it must be replaced by more succulent and palatable grasses and clovers. Old

ratstail, with its mass of deep and fibrous roots, is extremely hard to plough, and altogether the breaking-up and resowing of a paddock is a very costly affair. Moreover, even when a fresh sward of grass is established the same process of reversion will take place unless the fertility is maintained by means of top-dressing.

There is a cheap and efficient method of rapidly converting dry, harsh ratstail into a good dairy pasture. Its success depends on the fact that ratstail has taken charge, not because it is an aggressive species and has thus ousted the rye-grass and cocksfoot, but because the soil-fertility has fallen so that these species cannot thrive, and therefore are replaced by ratstail, which soon smothers out the clovers by shading them. The method is to remove the shade, increase the fertility, and introduce the new grasses and clovers under these conditions. Rye-grass, cocksfoot, and clovers will then compete successfully with ratstail, which, moreover, after top-dressing, becomes more palatable, and is eaten down accordingly.

The paddock should be closed from the late autumn on, so as to allow of plenty of growth for a clean burn. The ratstail is fired in September while the ground is still moist. This prevents the fire from burning too close to the ground and so destroying the few remaining stunted rye-grass and cocksfoot plants which have managed to survive. The ash from the fire forms a good seed-bed, and on it is sown a mixture of rye-grass, cocksfoot, crested dogstail, and red and white clover, with 3 cwt. to 4 cwt. per acre of superphosphate. An average mixture suitable for the purpose would be: Italian rye-grass, 4 lb.; perennial rye-grass, 6 lb.; cocksfoot, 5 lb.; red clover, 4 lb.; white clover, 1 lb.; crested dogstail, 2 lb.: total, 22 lb. per acre.

It will often be found that the top-dressing brings away many old and stunted rye-grass and cocksfoot plants which have been for years covered by the ratstail, and for this reason in cases where the pasture was originally sown in English grasses, and the area has not been burnt over to any extent, only clovers need be sown. The grass and clover seed can be mixed with the superphosphate, but must be sown soon after mixing. Many excellent pastures are to be found which have been built up by annual top-dressings with phosphates following the above-described initial process of replacing the ratstail by surface-sown grass.

The winter feeding of ripened hay from a good top-dressed pasture, together with roots such as mangolds or swedes on ratstail pastures such as described, is another sure and cheap method of raising the fertility, introducing fresh grass-seed, and so creating conditions such that the English grasses can once more compete successfully with the ratstail. Both these methods have been used with complete success.

—*Fields Division.*

LAMBING-PENS.

In many cases, more especially with flocks of up to, say, 2,000 ewes, it is very convenient to have a small yard with a few lambing or mothering pens. The yard should be fenced off in the corner of the lambing-paddock, with strong stakes driven well into the ground and just the length of a hurdle apart. Wire the hurdles to the stakes,

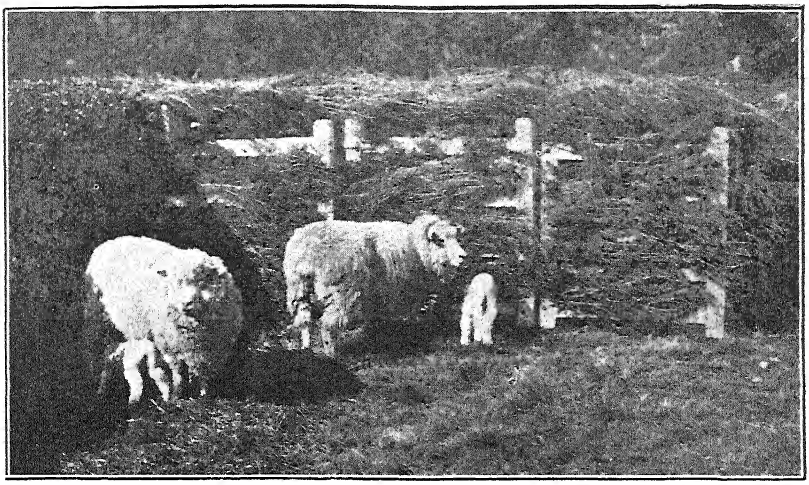


FIG. 1. LAMBING-PENS AT WALLACEVILLE LABORATORY FARM.

Manuka scrub was used in the construction of these. The three pens are here shown closed.

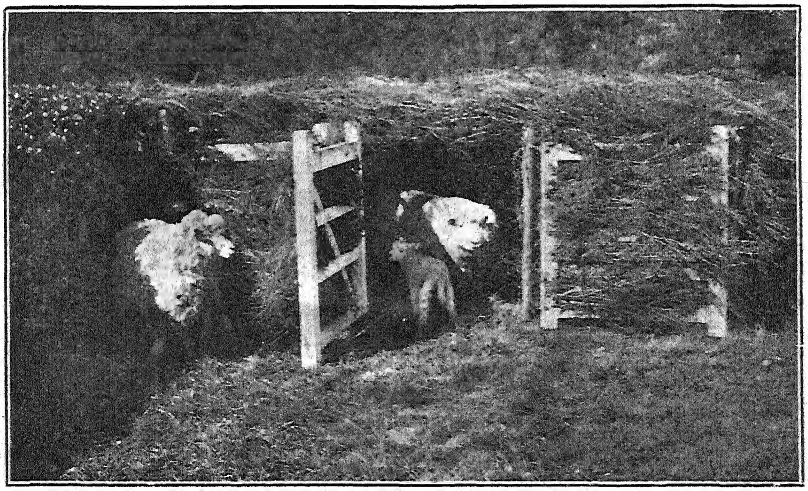


FIG. 2. SHOWING ONE OF THE PENS OPEN, WITH EWE AND LAMB INSIDE.

[*Photos by H. Drake.*

leaving a gateway close to the main fence. Then make up bundles of straw or brush and stand them on end on the other side of the fences, particularly on the side that the prevailing wind comes from during the lambing-period. Tie the bundles there with light wire, flax, or binder-twine, also round the part where the hurdles are fixed. Now fix up the pens, which will require to be large enough to allow the ewe

to move about comfortably. Fasten one end of the hurdle to the fence where the straw is placed, and drive in a stake to fasten the other end to. Having fixed up the number required, put another hurdle across the front, making one end secure and leaving the other loose until the pen is required for use. Then place a few rails or battens along the tops of the pens, and place the straw or brush on these. This forms a roof and helps to keep the ewe quiet when put in, besides giving her and the lamb protection from rough weather. This sort of lambing-yard will be found especially useful for merino ewes that have been mated with longwool rams.

—*J. G. Cook, Live-stock Division.*

THE ORCHARD.

SPRAYING OPERATIONS.

Just when to commence spraying and what mixtures and strengths to use will be the dominant thought in growers' minds during the early weeks of September. The results obtained during the previous season should form a guide as to future procedure. The growers who succeeded in getting a crop of apples free from black-spot (or practically so) will, if they be sensible, repeat the programme of last year, and the careful man will have his data at hand.

That one grower will get good results from the same mixture and strength while his neighbour gets the reverse is often true, but the mixture cannot be to blame, and we must look to some other factor for the cause. Was it the time of application? Was it lack of care? Or did the wet spell, unfortunately, come at the wrong time? The weather factor is not in our hands, but we can make the best of our opportunities by seeing that the pump is in good working-order and hoses tight. If the spray is on and a downpour comes, one should not wait until the scheduled interval elapses between sprays, but get to it as soon as possible and adjust the strength of mixture to suit the conditions, getting on two fungicides ahead of the bloom period if the best results are desired.

The strength found most suitable in the locality for the varieties grown should be used, as local conditions vary greatly. If bordeaux is fancied for a start, my advice is 5–4–50 at tight to open cluster, and ten to twelve days later lime-sulphur, 1–50, on the harder kinds. Otherwise lime-sulphur, 1–20 to 1–25, followed by 1–50. If a little russet does not matter, bordeaux, 3–4–50, can be used for the second application; but if red-mite eggs are present on the trees beware of trouble, for mites take a lot of catching after the bloom period. When bordeaux is decided on, the trees should receive an application of red oil of a strength consistent with the stage of development.

The spraying of pear-trees was fully dealt with in last month's notes. In some localities, however, it may be found that one spray of bordeaux, 3–4–50, at open-cluster is quite sufficient for the Winter Cole and Josephine varieties.

A further application to stone-fruit trees of bordeaux, 3–4–40, at colour-bud will help to further check leaf-curl, shot-hole, &c., and help to prevent brown-rot, but if growers wish to secure the best results all mummy fruits must be destroyed.

CULTIVATION.

Many orchards have not yet received the annual ploughing. This should be done before the time arrives for black-spot spores to germinate. Green crops will also be ready to plough under about this time. Some lupin crops are already well in bloom and at their best for turning under. Trees should be dug round also, to bury as many leaves as possible. Where digging has been neglected for a season it is very necessary, as the rubbish also forms cover for brown-beetle, earwigs, leaf-hopper, &c. Cultivation near the tree has more advantages than disadvantages in many respects, and well repays the necessary outlay.

GRAFTING.

The working-over of unsuitable varieties to more popular sorts can be undertaken towards the middle of September and for a couple of weeks later. Where there is a good foundation in the trees, use should be made of several of the limbs, as much quicker returns will thus be secured. About four to six limbs may have scions inserted. A couple of the original branches should be left to allow the trees to function properly, and also control to some extent the liability to silver-blight, but care must be taken that no swaying branches are in close proximity to the scions, otherwise they may be torn out.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

In the majority of citrus groves little or no autumn growth was made last season, owing mainly to the prolonged dry spell. With the late abundant rains and the advent of warm spring conditions trees will in all probability make more spring growth than usual. In anticipation of this, seasonable work for the month will be as follows :—

Planting : Where replacements are required or new plantations are being made, an effort should be made to complete the work by early September.

Pruning : Complete the work outlined in the July *Journal*, and treat all borer-cavities by an injection of benzine, afterwards blocking the hole with soap or putty.

Cultivation : Towards the end of the month spring cultivation should be carried out. This includes ploughing, to turn in green crops which have been grown for that purpose, or weeds, which are best disposed of at this period by being turned under. Even if the soil is in a clean condition, ploughing at this period is beneficial, as it breaks up the compacted state and permits aeration. In most citrus groves there is an area near the trunk of the trees which cannot be ploughed or cultivated by horse-implements. In order that this area may be dealt with by the hoe later in the season spade-work is necessary at the present time. If this land is not dug over now fibrous roots become so dense later on as to make it inadvisable to more than scratch the surface for fear of injuring the roots. On the other hand, digging the land now, when fibrous roots are least plentiful or necessary, a condition is secured which allows several inches of soil to be kept in good tilth during the summer.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

HATCHING CHICKS AND DUCKLINGS.

The end of September, or, at any rate, early in October, may generally be regarded as the end of the correct season for hatching out chicks of any breed, because chicks brought out later seldom or never prove satisfactory. Thus no time should be lost in placing the last of the eggs in the incubators or under the natural mother. There are many factors to be considered in successful poultry-keeping, but there is not one factor of greater importance than the avoidance of having late-hatched stock on the plant. In these days of high-cost foodstuffs it is particularly important that the young stock be hatched out during the early season.

There is yet ample time to hatch out ducklings for the renewal of the laying flock, but September should see all eggs undergoing the process of incubation for the production of ducklings for the Christmas market. To cater for this trade the eggs should be put down about fifteen weeks before the young birds are to be marketed. This will allow twenty-eight days for hatching (the natural time), and the remainder for rearing the birds to prime condition. In this connection it is always a wise course—whether it be with table ducklings or poultry stock intended for the Christmas trade—to market them at least a few days before the festive season sets in. In this way those poulterers who cater for the best trade are given an opportunity of preparing the birds for market and placing them in the freezer to await for the rush.

A little point may be mentioned here in regard to mating ducks. They should be mated well in advance before the eggs are required for hatching purposes, or a high percentage of infertile eggs may be expected. Usually ducks, especially the heavy breeds, have to be mated much longer than fowls in order to ensure a maximum number of fertile eggs.

THE NON-LAYERS IN WINTER.

A correspondent who has been looking for eggs for many weeks past from his adult flock, and without any result, is now getting tired of poultry. He asks whether, in view of the present cost of food and declining price of eggs, it would not pay better to cull out the birds rather than continue feeding them for nothing. Although these fowls have been earning nothing during the past few months I would advise this and other correspondents in a similar position not to resort to drastic culling at the present time of year. This work should have been done in the autumn. The natural laying season for bird-life is approaching, however, and it will be a very inferior fowl that will not pay her way, even if foodstuffs are dear, before the next moult comes on. Of course, the better the feeding and general management a bird receives the earlier will she come into profit. Failure to secure eggs in the season of high prices is usually put down to bad luck, but more often than not is the result of bad management, some essential detail having been neglected. It must be realized that late autumn and winter eggs are an artificially produced product. Therefore if they are to be secured in good numbers the pullets which are hatched in other

than the natural season must be chiefly relied upon to produce them. Neither late-hatched pullets nor adult hens can be depended upon in this respect. Practically any old hen will lay during the spring and summer season when eggs are cheap. The secret of winter eggs is to have the full complement of chicks hatched out at the earliest date possible.

MARKING CHICKS AND ADULT BIRDS.

Few poultry-keepers realize the value of marking their chicks in order to distinguish the young from the old when culling is necessary—as it is every season if only profitable birds are to be retained. There is practically no definite means of telling the age of a bird by its general appearance. This being so, the punching of a distinctive mark in the web of the foot will serve as a good means of age-determination. It should be remembered that even in the best of flocks the egg-returns from second-season birds are at least 30 per cent. lower than in the pullet season, while the cost of production is just the same; and the yield more rapidly decreases after the second year. Therefore this necessary detail should not be delayed. It is the only safe means whereby the common mistake may be obviated of sending a young profitable bird to market and retaining an old unprofitable one. A punch made for the purpose can be purchased for about 2s. With this the chicks can be marked when leaving the incubator, and by keeping a register the different strains and ages of the birds can be ascertained at a glance.

For marking adult birds one of the most effective and cheapest rings is that commonly used in a pig's nose to keep it from rooting. These are obtainable in both the round and flat forms. They may be easily put on the leg of a fowl with a pair of closing pinchers as used for ringing a pig, and when once on there is little or no chance of their falling off. For pedigree-breeding purposes the flat rings may be numbered by means of a small set of steel punches numbering from one to zero.

NON-ABSORPTION OF YOLK IN CHICKS.

Failure to absorb the yolk of the egg, which is drawn into the body of the chick just before it leaves the shell, is a common cause of mortality during the brooder stage. It is generally believed that failure of the yolk to digest is due to feeding the chicks too soon after hatching, or to overfeeding during the first week. It is also often considered that breeding from overfat hens is responsible. These factors may have some influence in regard to this condition of the yolk, but experience goes to show that it is due more to improper incubation than to any other cause. This is borne out to a great extent by the fact that the trouble is seldom found in chicks that have been hatched by the natural mother. There it will be found that the yolk in its sac is in a more or less liquid state, which enables it to run freely and finally become absorbed. With incubator-hatched chicks the chief weakness probably lies in having the temperature too high during the whole or a part of the incubating-period, thus causing half-baking of the yolk and rendering it incapable of absorption. If such trouble is to be minimized it is of the first importance that every care should be taken to prevent an excessive degree of temperature in the incubator.

GREEN FEED.

In these days of high-priced foodstuffs poultry-keepers in general will be well advised to give more attention to growing green feed. In districts favourable for the growing of lucerne I would advise the establishment of this plant. Where local conditions are not favourable for the growing of lucerne it is well to provide a substitute. An excellent plant for the purpose — one that can be grown practically anywhere, and which gives a great wealth of feed during the greater part of the year—is silver-beet. Where watercress is available nothing more is required by way of green-stuff. It not only has the effect of maintaining a bird in good health, but gives a good colour to the yolk of the egg. There is, as a matter of fact, a great variety of plants to select from for green-feeding purposes. Rape, cabbage, carrots, and clover may be grown to advantage. Green oats cut when short and finely chaffed are also good. For choice, however, as a laxative food and for the average locality, I would recommend silver-beet.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

SPRING WORK.

By this time the first examination of the hives should have taken place. As stated last month, the question of stores is of first importance, and every effort should be made to provide the bees with ample food to carry them on until nectar is available. Owing to the exceptional severity of the winter this year, particularly in the South Island, it may be found in many cases that the bees have not consumed as much honey as usual. The weather conditions will probably also have influenced brood-rearing to a large extent, and, although brood may normally be found in the hives by the end of July, this year abnormal conditions have prevailed, and it will be unwise to judge a colony queenless because there is no brood showing at a first examination. With the advent of warmer weather the colonies will soon build up to their usual strength.

When colonies are weak, or show other signs of a poor queen, it is best to kill the queen and unite the colony with a stronger one. It is useless to try and carry a poor colony on to the summer. By the time new queens are available it will have nearly dwindled out of existence, if it has not been robbed out ; and even if it lives until it can be requeened it will hardly build up sufficiently to give a surplus in the coming season. Only strong colonies should be tolerated in an apiary, and it is much the better plan to dispose of all the weak stocks and prepare the hives thus vacated for increase later on. A simple method of uniting is to place the weak colony over the strong one with a single sheet of newspaper between the two hive-bodies. The bees will gnaw the paper through and unite quite peacefully in a day or two.

PRECAUTIONS AGAINST ROBBING.

All work which necessitates opening the hives should be carried out as expeditiously as possible, and no hives left open longer than

can be helped. No combs should be exposed to the bees at this time of the year. It is a good plan to carry an empty super round on a barrow, in which the end combs can be placed and covered while the work of examining the colony is going on. It is necessary to remove one comb at least, so that the rest may be easily handled, but this comb, however dry, is as well kept out of the way of would-be robbers. Spring robbing, once started, may become as disastrous as autumn robbing, and must on no account be encouraged. All feeding should be carried out just before dusk, and if any syrup is spilled it should be at once covered up or removed out of harm's way.

STARTING AN APIARY.

The beginner who is desirous of starting an apiary may commence at any time now. For the next month or two he will only be able to obtain established colonies, as swarming is still several months ahead. If he decides to commence at once, and thus obtain the full benefit of the season's experience, he should get into communication with a reliable breeder and obtain nothing but absolutely guaranteed stocks. On no account must the tyro be led away by the apparent cheapness of bees offered for sale. If he should contemplate purchasing any other than those of any apiarist who makes the sale of bees his business he should have his prospective purchase examined by some person of experience, and be quite certain of the cleanliness of the colonies before taken possession. The sale of diseased bees is forbidden by law; but, apart from that, they are a dear bargain, as they will cost much in money and time to bring them to a healthy condition, and, moreover, will yield nothing during the first season. A good hive purchased now, placed in a sheltered position, and carefully watched to see that its stores are sufficient to last it till nectar is abundant will probably (if the apiarist desires it) yield a good swarm, and both parent hive and swarm should give a surplus when the main honey-flow arrives.

ISAAC HOPKINS.

The death of Mr. Isaac Hopkins, the well-known bee-master, removes a conspicuous figure from the apicultural world. Not only was he familiar to most New Zealand apiarists, but his reputation as an ardent student of the craft extended to almost every country where apiculture is practised.

For the past fifty years Mr. Hopkins had been closely associated with apicultural development in New Zealand. Starting with a gin-case hive in 1874, he at once saw that there were great possibilities for development of the business. Not satisfied with the methods in vogue at the time, he tried in succession types of bar-frame hives such as the Stewarton and others, but as these proved only to be a slight improvement on the gin-case they were soon discarded. In 1879 Mr. Hopkins secured a copy of "Langstroth on the Honey-bee," and from this work obtained specifications of the first movable-frame hives. As these proved to be a distinct success, a number were made and brought into use the same season. In the same year he imported a direct shipment of modern bee-supplies from Root's, including a comb-foundation mill. The establishment of his apiary at Parawai, Thames, replete with the latest appliances of the day, was the subject of much

attention, and attracted many notable persons, including the late Sir George Grey, who was greatly interested in modern apicultural methods. Early in 1880 he contributed notes on practical apiculture to the *Thames Advocate* and the *Auckland Weekly Press*, and subsequently published the first edition of his "Bee Manual." This book was well received, and in thirteen months a second edition was published When publishing the third edition he altered the title to "The Australasian Bee Manual," finding that it had a wide circulation in Australia. The sixth edition is now in the printer's hands, and will be available shortly.

In conjunction with the late Mr. J. C. Firth, Mr. Hopkins established an apiary on commercial lines at Matamata. At this apiary he developed the breeding of Italian queens, and sent them to all parts of New Zealand, Australia, and several of the South Sea islands. At this time he successfully imported Holy Land bees and other races, but after an extended trial preferred the Italian race with which he had been so successful. Owing to ill health Mr. Hopkins removed to Auckland City in 1887, and then commenced to organize and take active interest in the New Zealand Beekeepers' Association. This organization under his guidance promoted the Foul-brood and Disease in Bees Prevention Act, which was introduced during the parliamentary session of 1888. Although the Bill was shelved, it created much interest in apiculture at the time.

In January, 1905, Mr. Hopkins was appointed Government Apiarist, and at once commenced to draft the first Apiaries Act, which eventually became law in 1907, and was consolidated in 1908. While Government Apiarist he forwarded samples of comb to Dr. E. F. Phillips, Washington, U.S.A., for examination. The comb proved to be infected with foul-brood (*Bacillus larvae*). This was the first indication that the disease was present in New Zealand. Mr. Hopkins was instrumental in starting the Ruakura State Farm Apiary, and also compiled the first edition of the departmental bulletin on "Bee-culture."

Rightly has Isaac Hopkins been named the "Father of Beekeeping in New Zealand." His long association with apiculture, his readiness to help beekeepers with the difficult problems of the craft, and, above all, his unswerving loyalty to New Zealand beekeeping interests will place his name in the honoured ranks of the pioneers who worked for the advancement of our primary industries.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

ANY fine, dry weather experienced in the spring of the year should be devoted almost entirely to the hoeing of growing crops and the preparation of the land for further cropping. The opportunities are sufficiently rare, and if they are not taken crops become overgrown and the weather is blamed; great losses are due to neglect in this respect. Cabbage, cauliflower, lettuce, artichokes, early potatoes, shallots, garlic, and onion plants put out during the months of July

and August will require this attention, also early peas, lettuce, and onion crops sown about that time.

During September the main root crops — parsnips, carrots, beet, main-crop peas, celery, leeks, parsley, and salads—should be sown.

Where the convenience of a hotbed is available, sowings of tomatoes, egg-plants, Chile peppers, cucumbers, and melons should be made at this period. The facilities are at hand on most farms. It is necessary only to realize the principles underlying the operation of making a hotbed. A quantity of *fresh* stable manure is required, sufficient to make a stack about 3 ft. high and 1 ft. wider and longer than the frame to be used. Place the manure in a compact heap, and in three or four days it will generate a considerable heat by fermentation. Then turn it over, shaking it out and moistening with water any portion that is dry. After a similar interval repeat the process, and again possibly a third time, the object being to have the whole mass in a state of steady fermentation. When ready, build the hotbed about the dimensions mentioned, and place the frame in position. In a few days it will be sufficiently hot, when it should be thoroughly watered, and it is then ready for use. It should be built in a sheltered, well-drained locality.

Preparation of the land for new plantations of rhubarb and asparagus should now be completed and the plants put out. Do not be tempted to plant before the land is ready; it is better to defer the operation for a year. Pulling of the variety known as winter rhubarb should now be stopped, and the plants given a liberal dressing of manure. Established beds of asparagus should now receive liberal dressings of manure. When doing this remember the special preference of asparagus for nitrate of soda.

The main potato crop is due for planting in the coming month. Every care should be taken to secure seed that is clean, true to name, unmixed, and of good strain. Remove the new shoots from sprouting kumaras as soon as they are of sufficient size, and heel them in closely in a well-sheltered position until the time comes for planting them out. Cover them with mats on nights when frost threatens.

Where tomatoes are to be grown under glass the plants should now be placed in their permanent positions if this has not been already done. If the house has been neglected during the winter and the soil has become very dry it should receive a good soaking with water before the plants are put out; otherwise it is usually best to keep the house rather on the dry side at this season. Land outside to be planted in tomatoes should now be carefully ploughed, turning the cover-crop growing on it well in. A dressing of lime before harrowing will usually be an advantage.

SMALL FRUITS.

Plantings of Cape gooseberries that are to be grown for a second season should be cleaned up towards the end of the coming month, the land ploughed, and a dressing of manure applied and harrowed in.

Plants of the edible passion-vine should now be planted out in their permanent quarters. Although they grow readily in quite indifferent localities, they will not continue to crop heavily without generous treatment.

Thoroughly clean strawberry-beds as the weather permits, and give them a good dressing of soluble fertilizers, harrowing the material in. Suppress all runners from plants expected to bear a crop of fruit.

TOBACCO.

Further tobacco seed-beds should be sown in the coming month; it is desirable to have extra beds in reserve in case of accidents or unusual weather conditions. Continue with the preparation of the land in which the seedlings are to be finally planted out. During the ensuing month, as the natural temperature then rises, is the correct time for fermenting stocks of cured tobacco-leaf. In order that due preparation might be made, details of this operation were given in the June number of the *Journal.*

TRANSPLANTING, PRUNING, AND TRIMMING.

September closes the season during which shrubs and trees may safely be transplanted. The sooner such work is now completed the better the results are likely to be. Any pruning or trimming of such plants that may be required should also be completed now. Too often does one see shelter-trees, hedges, &c., cut hard back during summer and seriously injured thereby. The most that can be done safely during the growing-period is to trim back the current season's growth. Most plants used for hedges will stand that treatment.

LAWNS AND GRASSES.

The feeding and top-dressing given to lawns during autumn and winter will now begin to show result in a strong growth of good colour of the finer grasses. To have the greens in high condition for summer games constant attention will be required in the way of cutting and rolling.

—*W. C. Hyde, Horticulturist.*

CASE OF PIGS SUCKING HEIFER.

MR. J. L. MORRIS, Inspector of Stock at Cambridge, sends the photo here reproduced, together with the following note: "Owing to my taking my annual leave I was obliged to put the heifer shown in the snapshot out on a neighbour's farm, as she was close to calving. She calved about the middle of January last. She had an abnormally large udder for a two-year-old beast, and just before she calved the milk was probably causing her pain. This, I think, caused her to take to the pigs. Directly the pigs were let out from the stye the heifer used to call to them, and it was very amusing to see them trotting up to her and sucking as gently as could be. I have seen as many as seven of them taking their turns at sucking—and great strong store pigs at that. It will be understood that the pigs were not allowed to run to her freely after the matter was first observed—only at times to give demonstrations to the sceptics and others. She was intended for a house cow, but we did not fancy her for that purpose after she took to the pigs."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RAGWORT TROUBLE WITH CATTLE.

"WEST-COASTER," Brunner :—

The rough unploughable parts of my paddocks are so badly infested with ragwort that the cows are forced to eat quantities of it along with the grass. In this case would the ill effects of eating it be counteracted by feeding some other foods; if so, what would you recommend, and would linseed-meal be beneficial? What remedies could be applied to a cow affected by eating ragwort?

The Live-stock Division :—

The effect on cattle from eating freely of ragwort is a condition known as "Winton disease." This results in cirrhosis of the liver, and is fatal in cattle and horses—no known treatment being of any avail. The condition has been produced by feeding quantities of ragwort experimentally, the disease in this way developing in about one month. Under natural conditions, when cattle are feeding in ragwort-infested paddocks the average period taken for the disease to develop is about three months. As your paddocks are so badly infested, removal of the cattle from them (if feasible) is the most advisable course to pursue. In other districts where the disease has appeared sheep have been used to graze off the ragwort. Although they are not entirely immune to its effects, sheep can eat a considerable quantity without showing any apparent symptoms of the trouble. In this way much of the plant in ragwort-infested areas may be got rid of. We cannot recommend any other foods to counteract the trouble. No medicinal remedy has so far proved efficacious.

TOP-DRESSING DRY GRASSLAND.

H. B. E., Hastings :—

Would you kindly advise me as to the best manure for top-dressing grassland? The land is situated at Longlands, on the banks of the old Ngaruroro River bed, and is a dry sandy loam that never gets waterlogged. One of my neighbours dressed part of his land with burnt lime, about 3 cwt. to the acre, but does not seem to know if it has been of much benefit.

The Fields Division :—

The soil conditions described are of such a nature that you are not likely to get results from liming. The whole of the Ngaruroro River bed is of a light stony formation, and the best results are obtained by using a soluble phosphate fertilizer. We advise top-dressing with 44–46 superphosphate at the rate of 2 cwt. per acre, applied in August.

SPRAYING FRUIT-TREES AGAINST BROWN-BEETLE.

"SUBSCRIBER," Te Puke :—

Will you please advise me the best spray for preventing brown-beetle from attacking fruit-trees? Year after year they swarm on to my trees in the evening and devour leaves, bloom, and shoots from peaches, plums, and apples. Is the small white-headed grub one digs up the beetle in another stage?

The Horticulture Division :—

The best method known at present for combating the attacks of brown-beetle on the foliage of fruit-trees in spring is a combined spray of arsenate of lead with a casein ingredient to thicken and help spread it. The larvæ of the beetle are the white grubs often found in light lands in considerable quantities, and well known as the "grass-grub."

PASPALUM FOR TAKAKA DISTRICT.

C. C., Takaka :—

I have an area of somewhat poor low-lying land growing manuka, light rushes, and fiorin, which I am draining and clearing. Might I expect any success in sowing paspalum after a burn? Also, I am ploughing some of this land and it is (at present, at any rate) too damp to think of cultivating frequently. Would you give some idea if it would be wise to sow this ploughed land in paspalum?

The Fields Division :—

Paspalum has been successfully established on certain areas in the Takaka district and should grow on your land, but is not likely to establish quickly or certainly from surface-sowing after a burn. You are advised to sow paspalum only after ploughing and as much cultivation as is possible under the adverse conditions mentioned. A mixture somewhat as follows is recommended: Cocksfoot, 10 lb.; perennial rye-grass, 15 lb.; white clover, 2 lb.; subterranean clover, 1½ lb.; Paspalum dilitatum, 8 lb.: total, 36½ lb. per acre. By ploughing the land prior to sowing the grass-seed, the latter is given a good chance to make its appearance before fiorin is able once again to come into possession. Of course, the sowing would be best made in March, but it may now be as well to sow towards the end of August. This practice, admittedly unsound in many other districts, would probably, under the climatic conditions of your locality, be fairly safe.

SCALE ON ACMENA FLORABUNDA TREE.

G. W. M., Whangarei :—

Please find enclosed a branch of *Acmena florabunda* attacked with scale. The scale is just commencing to appear on the lower branches of the tree. Kindly inform me how to destroy it without injuring the foliage.

The Horticulture Division :—

For controlling the scale on the Acmena you are recommended to apply red oil, ½ pint, diluted with 3 gallons water in early summer, when the plant has started into growth, repeating the application after about two or three weeks. Emulsify the oil in an equal quantity of water before diluting further.

NITRATE OF SODA AND PASTURE TOP-DRESSING.

F. S. Ruthe, Leigh, North Auckland :—

Could you tell me if nitrate of soda is a suitable manure for top-dressing grass and clover on a light volcanic soil? Also, will it mix with lime, and, if so, what is the best form and quantity of lime to mix it with?

The Fields Division :—

Nitrate of soda as a top-dressing will give an increased bulk of pasture, but at the expense of the available phosphates and potash in the soil. The nitrogen-supply is best maintained on a pasture and soil such as you mention by the use of phosphates and lime, which promote the growth of clovers and also create the most suitable condition for soil bacteria, both of which are able to make available for plants nitrogen in the form of nitrates. Again, the frequent use of the chain harrows, by spreading animal-manure containing large supplies of nitrogen, reduces the necessity for using high-priced artificial nitrogenous manures. Chain-harrowing also allows the air necessary to bacterial life to enter the soil. These bacteria also require lime and phosphate. Some are able to take nitrogen from the air and make it available to plants, and others make the nitrogen on dead vegetation and animal-droppings available while others living on the roots of clovers get nitrogen from the air and pass it on to the pasture plants. An application of 4 cwt. to 5 cwt. of lime every three to four years, and an annual top-dressing of 2½ to 3 cwt. per acre of superphosphate or basic super will give best results. Kainit, at the rate of 1 to 2 cwt. per acre or ½ cwt. of sulphate of potash, may be used profitably on such soils every few years.

HORSE WITH LAMPAS.

C. CAMPBELL, Takaka :—

I have a six-year-old horse troubled with lampas, and he is looking miserable and unthrifty. Kindly advise me what is best to do with him.

The Live-stock Division :—

The condition of lampas is quite natural, but may be accentuated when there is some irritating condition, as in stomatitis or teething, and is sometimes met with when an animal is suffering from stomach or bowel trouble. Soft feed should be given, and cold water be available. A dose of physic might be advisable.

DAIRY PASTURE FOR ASHBURTON LIGHT LANDS.

"DAIRYMAN," Westerfield :—

I should be obliged if you would inform me in what proportions to sow perennial rye-grass, red clover, cocksfoot, and Danthonia pilosa on the light land of Ashburton County. I propose to use the feed for wintering dairy cows. If you do not consider this mixture suitable, what would you suggest ?

The Fields Division :—

On the light lands of Ashburton County perennial rye-grass and red clover form pastures of very short duration. If permanence is a consideration it would be wise, therefore, to have cocksfoot, crested dogstail, white clover, and perhaps danthonia as the dominant constituents. The following mixture would be suitable : Perennial rye-grass, 8 lb. ; cocksfoot, 10 lb. ; crested dogstail, 2 lb. ; white clover, 2 lb. ; Danthonia pilosa, 4 lb. : total, 26 lb. Red clover is omitted for the reason that should it do well during the first year its effect, through providing too much shade, would be detrimental to the establishment of the bottom grasses such as crested dogstail, white clover, and danthonia.

PASTURE-ESTABLISHMENT ON COUCH-INFESTED PUMICE LAND.

C. B. R., Mount Maunganui :—

Would you kindly advise me of the best method of dealing with worn-out pasture badly infested with couch ? It is pumice land, which I am anxious to get into good permanent pasture.

The Fields Division :—

As your land is light in texture, any procedure to eradicate couch or twitch must include replacement of organic matter to build up the soil-fertility necessary for the successful strike and maintenance of a good permanent sward. You should graze the land as bare as possible, which will help to consolidate the area for the subsequent operations. Skim-plough immediately, setting the plough to turn as light a furrow as possible. This will expose many of the roots and runners of the twitch, and allow the sun and elements to wither them. As soon as the grass-turf appears to be dead under the furrow, skim-plough again, this time across the first furrow. The land may now stand for a fortnight at least, and then be deep-ploughed. Subsequent operations will consist of preparing a seed-bed for some heavy soiling and smothering crop, such as mustard or blue lupin. It would be advisable to give a dressing of about 1 ton of ground limestone on the furrow and harrow it in. The crop should be sown about October, and turned in as green manure in January. The land should then be well rolled and prepared for sowing down in March with a temporary pasture mixture—say, 25 lb. to 30 lb. Italian rye-grass and 5 lb. red clover. During the hot month of February any twitch that may appear should be harrowed to the surface and exposed to the sun. A liberal dressing of manure should be given at the same time as the seed—say, 2 cwt. to 3 cwt. per acre of superphosphate. Subsequent treatment of the pasture must aim at keeping up the fertility of the soil, so that the better English grasses will be quickly established when the permanent mixture is sown in autumn two years hence. Such treatment consists of systematic liming and manuring, the liberal use of the tripod and chain harrows, and recourse to the mower when the grass [illegible] to seed.

WEATHER RECORDS: JULY, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE stormy and unsettled conditions which were experienced at the close of June continued for the first ten days of July, particularly in the northern and east-coast districts, where some heavy rains and serious floods occurred. The Waikato River again burst its banks; and the snow which had fallen on the high country, melted by the rains, caused the rivers to be in high flood in South Canterbury.

There was an improvement in weather conditions for a few days after the 10th, but on the 13th dull and misty conditions were again experienced, and some heavy rains were reported during the next three days. Anticyclonic conditions (fine weather) followed until the 21st, when an extensive westerly area of low pressure brought rain and stormy weather again over the Dominion. This rain, however, was particularly acceptable in Otago, where fine and dry weather had been experienced for some time, in contrast to the northern and east-coast districts, which have suffered this winter from an unusual prevalence of cyclonic disturbances.

The barometer rose rapidly between the 24th and 28th, and continued normal, but unsteady, for the last three days of the month.

There were remarkable differences in the totals of the rainfall, even in close neighbourhoods, which makes generalization difficult. Timaru and Oamaru had the highest percentage above the mean for this month, both being over 100 per cent. above the July average. The Bay of Plenty and Taranaki districts were also above the average; but Auckland and Wellington districts, as well as parts of Otago, were below the mean of previous years.

There were several frosts in many parts of the country, but on the whole the weather was mild and humid.

—*D. C. Bates, Director.*

RAINFALL FOR JULY, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
	North Island.			
	Inches.		Inches.	Inches.
Kaitaia	3·78	14	0·58	5·96
Russell	5·95	18	1·64	4·26
Whangarei	4·46	19	0·75	8·33
Auckland	4·17	20	1·15	5·05
Hamilton	6·44	20	1·36	5·24
Kawhia	6·23	20	1·62	6·86
New Plymouth	7·53	19	1·24	6·35
Riversdale, Inglewood	11·49	17	2·33	9·93
Whangamomona	6·87	13	1·88	7·68
Tairua, Thames	8·72	12	2·82	5·15
Tauranga	5·40	16	1·60	4·94
Maraehako Station, Opotiki	6·56	11	2·46	4·45
Gisborne	5·20	16	1·05	5·21
Taupo	4·76	11	1·62	4·21
Napier	5·15	16	1·00	3·82
Maraekakaho Station, Hastings	5·11	19	1·19	3·65
Taihape	2·43	18	0·58	3·33
Masterton	4·19	20	0·75	4·43
Patea	4·55	17	0·79	4·10
Wanganui	2·46	11	0·69	3·63
Foxton	2·56	5	0·80	3·26
Wellington	4·37	19	1·40	5·61

RAINFALL FOR JULY, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	6·34	22	1·55	6·99
Greymouth	9·85	19	2·83	8·43
Hokitika	13·80	19	3·52	9·10
Arthur's Pass	11·22	15	1·55	12·53
Okuru, Westland	23·62	17	2·58	12·03
Collingwood	11·54	23	2·87	9·65
Nelson	4·94	17	1·18	3·47
Spring Creek, Blenheim	3·40	13	0·90	3·93
Tophouse	3·72	15	1·10	5·65
Hanmer Springs	5·95	9	1·94	5·15
Highfield, Waiau	4·47	10	1·56	3·63
Gore Bay	3·58	13	1·15	3·31
Christchurch	2·98	15	1·31	2·77
Timaru	4·22	11	1·12	1·95
Fairlie	6·65	10	1·80	2·72
Benmore Station, Omarama	1·18	13	0·24	1·74
Oamaru	3·71	11	1·11	1·78
Queenstown	1·65	5	1·11	2·01
Clyde	1·08	8	0·44	0·94
Dunedin	5·99	15	1·50	2·99
Gore	1·55	13	0·40	2·05
Invercargill	1·32	8	0·38	3·41

GRADINGS OF BUTTER AND CHEESE, 1924-25.

THE Dominion quantities of butter and cheese graded for export by the Dairy Division during the year ended 31st July, 1925, were as follows :—

Butter : Salted, 65,634 tons ; unsalted, 4,582 tons : total, 70,216 tons—an increase of 13·6 per cent. compared with the figures for the preceding twelve months.

Cheese : White, 45,990 tons ; coloured, 24,003 tons : total, 69,993 tons—a decrease of 5·2 per cent.

In terms of butterfat, the 1924–25 amounts for butter and cheese combined represent a net increase of 6·8 per cent. compared with those for the preceding year. An advanced high-level record has thus been established for the Dominion.

IMPORTATION OF FERTILIZERS: JUNE QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 30th June, 1925 :—*Sulphate of Ammonia :* From United Kingdom, 50 tons ; Australia, 278 tons. *Nitrate of Soda :* Australia, 30 tons ; Chile, 433 tons. *Basic Slag :* United Kingdom, 8,399 tons ; Belgium, 17,969 tons. *Bonedust :* Australia, 305 tons ; India, 625 tons. *Chardust :* Australia, 206 tons. *Phosphates :* Nauru Island, 26,442 tons ; New Caledonia, 1,978 tons ; Egypt, 3,000 tons. *Superphosphate :* Netherlands, 500 tons. *Kainit :* United Kingdom, 294 tons ; France, 478 tons ; Germany, 280 tons ; Belgium, 85 tons. *Muriate of Potash :* France, 10 tons. *Sulphate of Potash :* United Kingdom, 50 tons ; France, 145 tons ; Germany, 252 tons ; Belgium, 20 tons. *Potash, other :* United Kingdom, 135 tons ; France, 670 tons ; Germany, 339 tons ; Belgium, 33 tons.

Correction.—At the head of the first article in this issue the degree of the writer, Mr. Hopkirk, should have been printed as B.V.Sc., not B.Sc.

LIST OF QUALIFIED VETERINARY SURGEONS.

THE following list of qualified veterinary surgeons known to be residing in New Zealand at the present date is published for the guidance of stockowners and for general information. In the event of the name of any properly qualified veterinarian being omitted it is requested that he communicate with the Director of the Live-stock Division, Department of Agriculture, Wellington, giving particulars of his qualification, in order that the necessary steps may be taken for the inclusion of his name in the next published list.

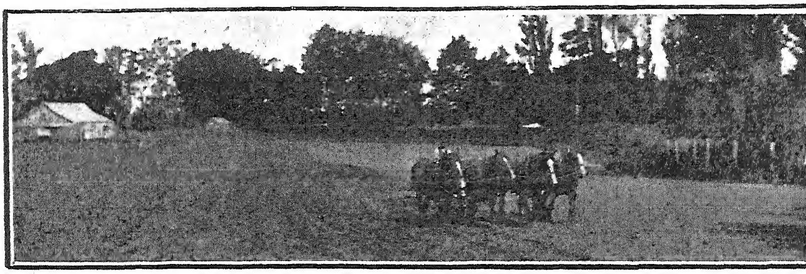
Aberdeen, C., L.V.Sc. (Melb.), Wanganui.
*Ashe, G. G., M.R.C.V.S., Belfast.
Barnes, A. W., M.R.C.V.S., Hastings.
*Barry, W. C., M.R.C.V.S., Auckland.
Bayley, A., M.R.C.V.S., Hawera.
Begg, W. P., M.R.C.V.S., Dargaville.
*Blair, W. D., M.R.C.V.S., Dunedin.
*Blake, T. A., M.R.C.V.S., Masterton.
Brodie, A. M., M.R.C.V.S., Hastings.
*Broom, G., M.R.C.V.S., Gisborne.
Burton, S., M.R.C.V.S., Hamilton.
Carbury, H. W., M.R.C.V.S., Te Aroha.
Cockroft, J. E., M.R.C.V.S., Feilding.
*Collins, W. T., M.R.C.V.S., Wellington.
Crossley, F., M.R.C.V.S., Palmerston North.
Cunningham, T., M.R.C.V.S., Oamaru.
*Danskin, J., M.R.C.V.S., Invercargill.
Davis, W. R., M.R.C.V.S., Wellington.
*Dayus, C. V., M.R.C.V.S., Auckland.
*Elphick, E. E., M.R.C.V.S., D.V.H., Hastings.
Fletcher, S., B.V.Sc. (Melb.), Whakatane.
*Gill, D. A., M.R.C.V.S., Palmerston North.
Glover, F., M.R.C.V.S., Hamilton.
Gregory, J. S., B.V.Sc. (Melb.), Leeston.
Hankin, T. H., M.R.C.V.S., Pukekohe.
*Haugh, P., M.R.C.V.S., Wanganui.
*Hickman, A. J., M.R.C.V.S., Auckland.
*Hopkirk, C. S. M., B.V.Sc. (Melb.), Wallaceville.
Howard, E. C., M.R.C.V.S., Wanganui.
Johnson, A. A., F.R.C.V.S., Christchurch.
*Kerrigan, J., M.R.C.V.S., Christchurch.
Kyle, H. S. S., G.M.V.C. (Melb.), Templeton.
*Lawson, J. N., B.V.Sc. (Sydney), Dunedin.
*Le Souef, H. D., B.V.Sc. (Melb.), Wellington.
*Lukey, E. J., B.V.Sc. (Melb.), Christchurch
*Lyons, J., M.R.C.V.S., Wellington.
*Mackenzie, A., D.V.S.M., M.R.C.V.S., Hamilton.
*Marsack, H. L., V.S. (Ontario), Auckland.
Marshall, D., M.R.C.V.S., Balclutha.
Martin, H. E., M.R.C.V.S., Christchurch.
*McGregor, P., M.R.C.V.S., Christchurch.
*McIlwaine, J. E., M.R.C.V.S., Wellington.
*Meade, R. H., M.R.C.V.S., Palmerston North.
Miller, J., M.R.C.V.S., Invercargill.
*Paterson, A. M., M.R.C.V.S., Timaru.
Quinnell, W. C., M.R.C.V.S., Wellington.
*Reakes, C. J., M.R.C.V.S., D.V.Sc., Wellington.
Ring, W. C., V.M.D. (Penn., U.S.A.), Ellerslie.
Siddall, E. L., M.R.C.V.S., Opotiki.
Simpson, C. S., M.R.C.V.S., Auckland.
*Snowball, W. D., M.R.C.V.S., Dunedin.
Stafford, J., M.R.C.V.S., Christchurch.
†Stapley, W., M.D., D.V.Sc., M.R.C.V.S., Cambridge.
Taylor, A., F.R.C.V.S., Christchurch.
Taylor, H. C., M.R.C.V.S., Dannevirke.
Taylor, J. B., M.R.C.V.S., Waverley.
Taylor, W. G., M.R.C.V.S., Tokomaru Bay.
*Thompson, A. L., M.R.C.V.S., Wanganui.
*Webster, W. M., M.R.C.V.S., Ngahauranga.
*Wood, R. B., M.R.C.V.S., Waitara.
Young, A. R., M.R.C.V.S., Bell Block.

* Officers of the Department of Agriculture.
† Not practising as a veterinary surgeon.

ARRAN VICTORY POTATO.

IN 1921 the Agriculture Department obtained from England a small quantity of Arran Victory potatoes, a variety then lately introduced. It was claimed to possess good cropping and blight-resistance characteristics, and to be immune from wart-disease. Since then the variety has been well tested in co-operation with several leading potato-growers in the Auckland District, notably Mr. E. J. Bilkey, of Pukekohe Hill, and his brother at Taupiri. At the latter place it was grown on light, good-quality loam typical of the better parts of the Waikato. Mr. T. H. Patterson, Instructor in Agriculture, Auckland, reports that in these trials Arran Victory has proved a consistently good cropper, and that it resists blight. The flavour and texture are excellent for the table. It is considered doubtful, however, whether the variety would become popular on the local market, which favours a white-skinned potato. Arran Victory has a red skin, with a bluish tinge near the eyes.

Live-stock and Crop Statistics.—This year's interim returns show a decrease in total cattle—3,500,832 head as compared with 3,563,497 in last year's final figures. Dairy cows taken separately, however, record a small increase—namely, 1,320,203 from 1,312,589. The area under turnips last season is shown as 452,956 acres, a decrease of 24,425 acres; but the mangold area increased from 9,989 acres to 15,047 acres.



The New Zealand

Journal of Agriculture.

Vol. XXXI.—No. 3.

WELLINGTON, 21st SEPTEMBER, 1925.

NAURU AND OCEAN ISLANDS PHOSPHATE.

POSITION OF THE STATE UNDERTAKING.

OUTPUT AND DISTRIBUTION.

The close of the first quinquennium, on 30th June last, of control of the Nauru and Ocean Islands rock-phosphate industry by the British Phosphate Commission affords an appropriate occasion for briefly reviewing the position.

It will be recalled that the production and sale of phosphate from the two islands is conducted by the Commission on behalf of the Governments of Britain, Australia, and New Zealand in partnership. Britain and Australia each provided 42 per cent. and New Zealand 16 per cent. of the capital of the undertaking. The agreement provided that for the first five years the partner countries should be entitled to phosphate in proportion to capital invested respectively, at a price fixed each year. Any output in excess of the partners' requirements was to be sold outside at the best rates obtainable. The partner countries receive interest at 6 per cent. on their capital invested in the undertaking, and redemption of capital within fifty years is provided for by a sinking fund. At the end of the first quinquennial period the allocation of phosphate to the partner countries was to be readjusted on the basis of their actual requirements, a similar review to be also made every subsequent five years.

The quantities and destination of phosphate rock shipped from Nauru and Ocean Islands during the first five-year period are shown in the following table :—

Year 1st July to 30th June.	Great Britain.		Australia.		New Zealand.		Other Countries.		Totals.
	Tons.	%	Tons.	%	Tons.	%	Tons.	%	Tons.
1920–21 ..	16,750	4·60	265,914	72·97	17,100	4·69	64,660	17·74	364,424
1921–22 ..	15,550	4·30	171,286	47·39	38,500	10·65	136,150	37·66	361,486
1922–23 ..	..	..	203,446	64·84	51,550	16·43	58,762	18·73	313,758
1923–24 ..	..	..	320,031	70·81	60,850	13·47	71,028	15·72	451,909
1924–25 ..	..	..	337,298	71·66	98,790	20·99	34,635	7·35	470,723
Totals, 5 years	32,300	1·64	1,297,975	66·15	266,790	13·60	365,235	18·61	1,962,300

This rate of total production is far in excess of output under the regime of the previous owners of the deposits, the Pacific Phosphate Company.

The heading of "Other Countries" in the table comprises Japan, Canada, and the Continent of Europe. In the five years Japan took 276,235 tons, equal to 14·08 per cent. of the total exports; the Continent, 87,900 tons, or 4·48 per cent.; and Canada, 1,100 tons, or 0·05 per cent. Japan has been a buyer each year of the five, and the Continent each year except the last; Canada bought only in 1923–24.

It will be noted that Great Britain has taken only a small fraction of its quota. This is due to the great distance, involving high freights, also to adverse exchange rates. At present Britain can obtain her phosphate requirements to better advantage from North African sources of supply. The position as regards Britain has enabled Australia to largely exceed its 42-per-cent. quota.

New Zealand did not average its full quota of 16 per cent. over the quinquennium, mainly owing to the importation of phosphate from Makatea Island in the earlier part of the period. Our requirements, however, are now being filled entirely from Nauru and Ocean Islands, and it will be observed that in the last year the Dominion took nearly 21 per cent. of the shipments. There is good reason to believe that the New Zealand demand will continue to expand steadily. For the year 1925–26 the requisitions are as follows: Auckland, 83,500 tons; New Plymouth, 12,000 tons; Wanganui, 3,000 tons; Lyttelton, 18,500 tons; Port Chalmers, 8,000 tons; Bluff, 2,000 tons—a total of 127,000 tons, as compared with 98,790 tons imported in 1924–25. It has been found, moreover, that these preliminary requisitions are usually exceeded. The present development of the New Zealand business will doubtless be given due weight in connection with the readjustment of the quotas of the partner countries which is now due for consideration

As regards the respective shares of the two islands in the trade, it is of interest to note that during the five-year period 1920 to 1925 Nauru shipped 1,112,216 tons of phosphate, and Ocean 850,084 tons.

Mr. A. F. Ellis, Commissioner for New Zealand, British Phosphate Commission, contributes the following notes :—

FUTURE SUPPLIES.

The question arises as to whether, in view of the rapidly increasing phosphate requirements of New Zealand and Australia, Nauru and Ocean Islands will be able to keep them supplied. It is considered by the Commissioners that this can be done, as the annual output is increasing, and important additions to the plant at each island will permit of much larger exportations in the course of two or three years. This will all be in the direction of lower working-costs, particularly as it is anticipated that the Commission will not require assistance from the partner Governments in financing the expenditure involved.

As the total exports from the two islands for the first five years are approximately 2,000,000 tons, some apprehension may be felt as to how long the deposits will last. There can be no doubt, however, that the

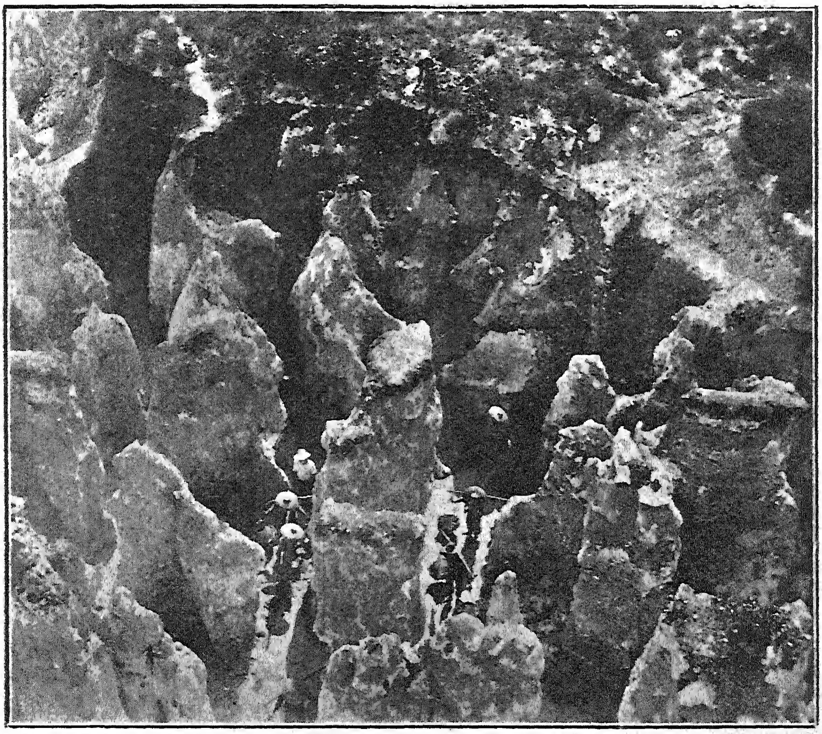


FIG. 1. MINING PHOSPHATE BY MANUAL LABOUR, NAURU ISLAND.

Chinese labourers with carry-poles and baskets can be seen at work transferring the phosphate to trucks. The pinnacle rocks consist of coralliferous limestone, and originally the surface of the phosphate deposit was level with the tops. In mining operations these pinnacles are disturbed as little as possible. In this locality the phosphate would be about 40 ft. in depth. Under certain conditions manual labour, as shown, is the most economical way of mining the phosphate.

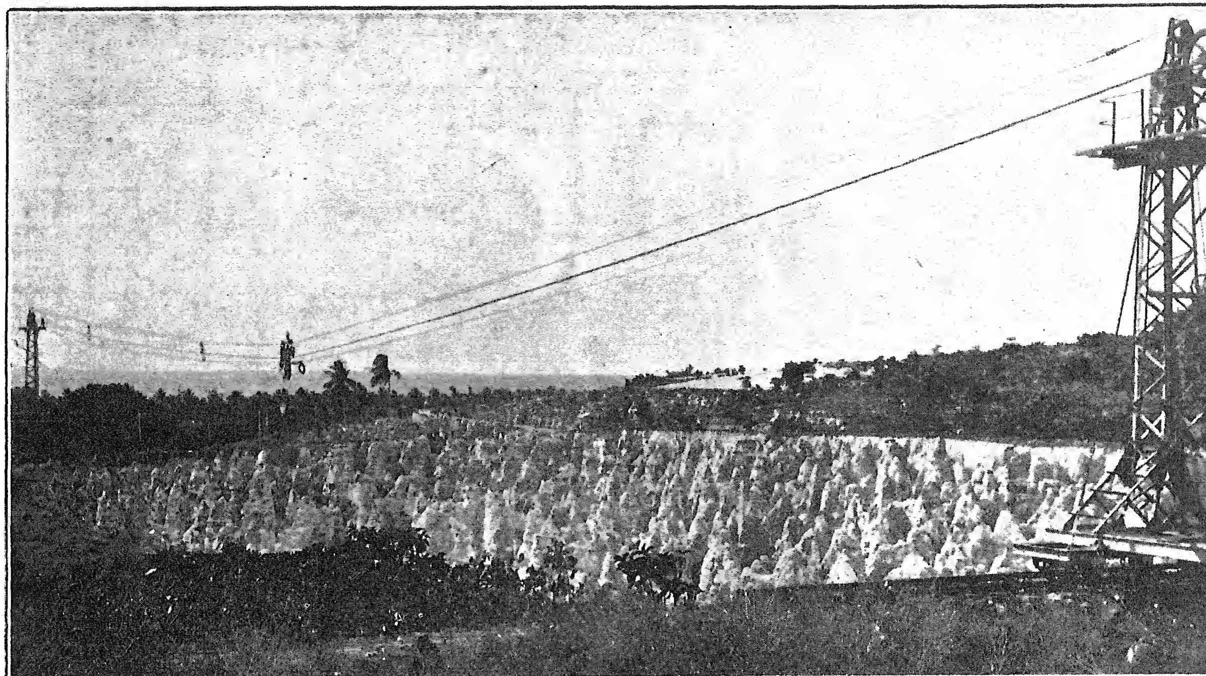


FIG. 2. MINING PHOSPHATE BY MODERN CABLEWAY PLANT AT NAURU.

This system is largely used, and proves to be the best mechanical method. The skips of phosphate are run along to far end of cableway and dumped in a hopper, where the trucks load by gravitation. These are run by locomotive to the rock-breakers, artificial drying plant, and storage bins. In the background a "covered-in area" may be seen. These structures are largely used in wet weather, the phosphate being removed from underneath them in a partially dry state. The roofing affords a useful supply of rain-water.

islands still contain supplies for over a hundred years, even at a largely increased rate of output. Nor is there any falling-off in quality; shipments continue to run from 85 to 88 per cent. tricalcic phosphate, permitting of the manufacture of the highest grade of superphosphate.

ORGANIZATION AND PLANT AT THE ISLANDS.

Though the industry has its special difficulties to cope with, the work at the Nauru and Ocean Islands proceeds evenly and smoothly on the whole. A minimum of labour troubles has been encountered during the past five years, and the general health of the employees has been satisfactory. An important factor in getting the present good results is the spirit of friendly emulation existing on each island, which asserts itself in the useful form of putting up shipping records. For a considerable time Nauru held the record with 2,900 tons shipped in one day, but recently Ocean Island did 3,460 tons, a remarkable performance when it is considered that the phosphate has to be lightered out to the steamers in surf-boats holding 3 to 5 tons only.

A recent interesting development has been the installation of wireless telephones on the two islands, which are 160 miles apart; the two managers can now discuss matters each day, and arrange shipping, &c., to best advantage, the result of their deliberations, advices regarding movements of vessels, and any other important developments being communicated promptly to the executive office of the Commission, in Melbourne, through the medium of the powerful wireless installation. The importance of this prompt system of communication cannot be overestimated.

Various additions to the plant for handling the phosphate have been made during the quinquennium just terminated, principally the installation of another aerial cableway, another artificial drying plant, an electrical dust-precipitating plant of an elaborate nature, railway extensions, &c. Important improvements in hospital accommodation, dwellings for the staff and labourers, water-storage, &c., have also been carried out.

With the two islands as at present a hive of industry and distributing their useful product to distant lands for the benefit of millions of people, it is interesting to the writer to look back to the year 1900, when, in company with another New-Zealander and an interested group of Natives, the first British flag to fly on Ocean Island was hoisted over their camp, and phosphate operations were started.

DEVELOPMENTS IN NEW ZEALAND.

With regard to the preparation of chemical fertilizer from the Nauru-Ocean raw material, the most noteworthy development in New Zealand of late years is that the demand for high-grade superphosphate, running 44 to 46 per cent., has quite cut out the previous usual grade of 36 to 38 per cent. super. This is economically sound, as a great saving in railage and other handling-charges is thereby effected. It appears that about four-fifths of the phosphate is made into superphosphate, and the balance is used either in mixtures, or applied direct in its finely ground state. There is still a good deal of difference of opinion as to which is the more suitable form in which to use the

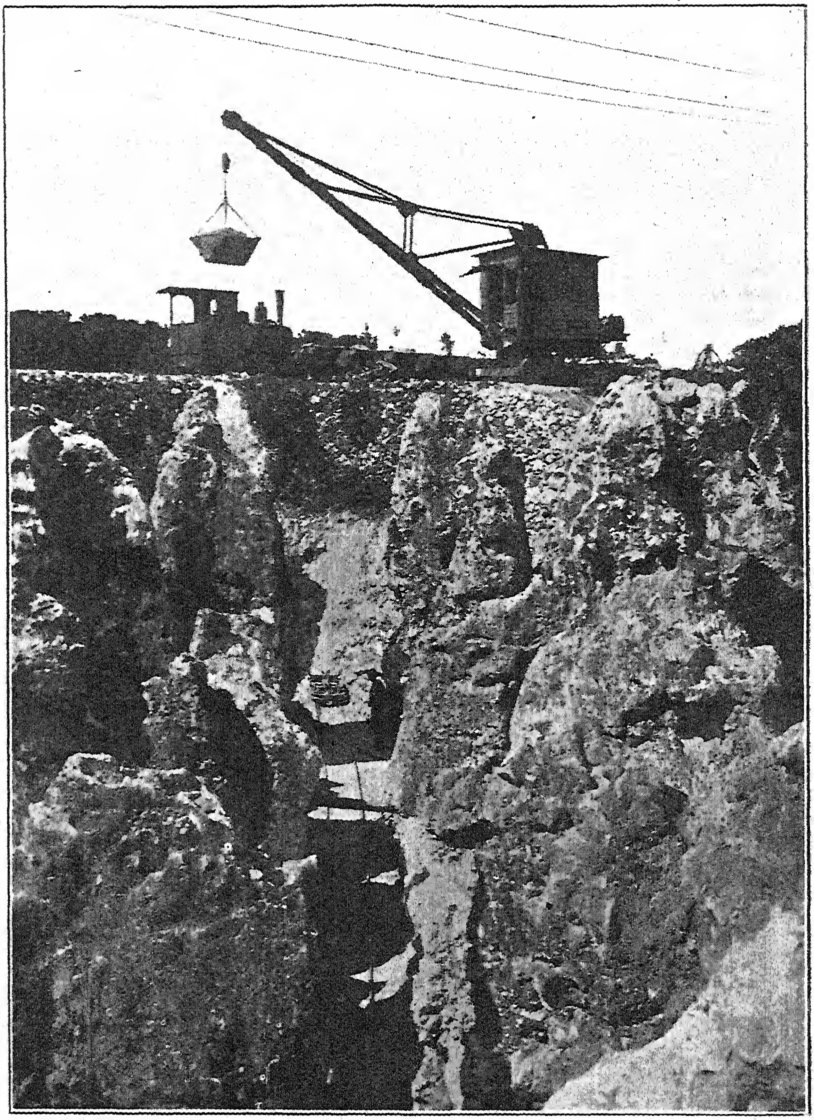


FIG. 3. MINING PHOSPHATE BY TRAVELLING CRANE AT NAURU.

This mechanical system is suitable under certain conditions. The phosphate deposit here was originally level with the upper railway-line. The bottom of the deposit has not been reached in this locality, but probably will give a depth of 40 ft.

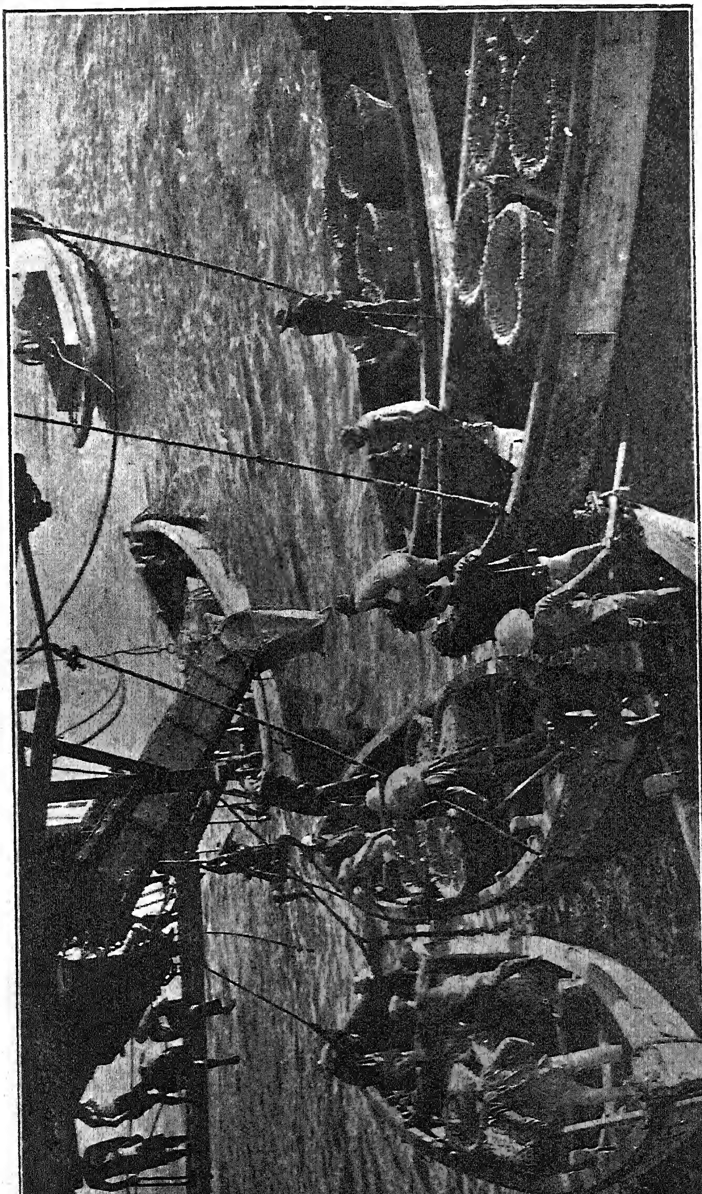


FIG. 4. METHOD OF SHIPPING PHOSPHATE BY SURF-BOATS, NAURU.

Phosphate is brought to end of cantilever jetty in trucks, which are dumped in a hopper, and the material runs down the chute to the lighters, each basket being filled in rotation. Oil-launches tow the boats off to the steamers, and the baskets, which hold about 15 cwt. each, are then hove up by winches, emptied in the holds, and returned to the boats. The shipment of 1,200 to 1,500 tons constitutes an ordinarily good day's work.

phosphate, whether as superphosphate, basic super, finely ground raw phosphate, or a mixture of super and the raw article. Probably each has its special place in New Zealand agriculture, dependent on the nature of the crop, the soil, and the climatic conditions; and it is for our agricultural experts to definitely determine just what the relative conditions governing the use of the phosphate are. This can most suitably be done by systematic field experiments rather than by laboratory research; Mother Earth knows best what is required.

The fertilizer-manufacturing works within the Dominion which handle the raw phosphate have developed in line with the increasing demand. Important additions have been made to the existing establishments in the vicinity of Auckland, providing for a much greater output. Large new works are approaching completion at New Plymouth, where the first cargo of phosphate will shortly be landed, and another large works at Wanganui will get going next year. Both of these are located in important agricultural and pastoral centres, and must favourably influence the regular supply of high-grade fertilizers at reasonable prices.

Both as regards quantity and quality the Dominion is fortunate in having an assured interest in these remarkable deposits, secured through the foresight and able statesmanship of our late Prime Minister. In future years, perhaps more than at present, it will be realized what a great service Mr. Massey rendered New Zealand in this matter.

PEAR-MIDGE PARASITES.

It will interest pear-growers to learn that the first consignment of parasites of the pear-midge arrived in New Zealand on 25th August. These insects were secured in Europe through the agency of the Imperial Bureau of Entomology, London, acting under a request from the Department of Agriculture. The attempt to rear these parasites and ultimately establish them in the pear-midge-infested areas of the Dominion is being carried out by the Biological Laboratory, Wellington.

Ragwort Poisoning.—The 1924–25 annual report of the Live-stock Division states that during the year deaths of cows attributed to ragwort poisoning occurred in Southland and also in some parts of Otago, and it is the opinion of the district veterinary officers that considerable mortality takes place yearly in the ragwort-infested areas through the ingestion of this weed. Wherever possible dairy-farmers should run some sheep to keep this and other weeds in check, as well as taking other more energetic control measures. Mr. W. D. Blair, Veterinarian, Invercargill, remarks that few cases of the acute form of ragwort poisoning came under notice—practically all the cases assumed the chronic form.

Compensation for Stock and Meat condemned.—During the official year 1924–25 compensation to the amount of £15,091 was paid out by the Agriculture Department for 5,872 animals condemned in the field for disease under the Stock Act, and £13,391 for carcases or parts of carcases condemned for disease on examination at time of slaughter at abattoirs and meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

TRACTOR VERSUS SIX-HORSE TEAM IN CANTERBURY.

NOTES ON FARM-SCHOOL DISCUSSION AT METHVEN.

A. H. COCKAYNE, Director of the Fields Division.

AN evening of the farm-school held at Methven at the end of last June was devoted to an open discussion on the comparative merits of the tractor and the six-horse team for farm tillage and cropping work under Canterbury conditions. Mr. J. Brown, of Lowcliff, Mr. W. W. Mulholland, of Darfield, and Messrs. W. M. J. Dart and A. McAnulty, of Methven, were the main speakers, but many other farmers present gave their views, ideas, and experiences, and many interesting points were brought forward. No complete record of the meeting was taken, and it has been suggested that, as the writer acted as chairman, he should give a brief survey of the main points that were discussed, together with a certain amount of critical comment.

The outstanding feature of the discussion was the general acceptance that c · normal six-horse-team farms it was generally impossible to arrange a satisfactory and payable cropping programme that did not entail the overloading of the team at various times of the year, and that therefore a reserve of power was necessary. This, it was argued, could be done only by having a spare team, by employing a contract team, or by the employment of a tractor. The writer fully recognizes the difficulty of arranging cropping programmes that provide sufficient work and no more for the team during the whole year. The position has become seriously complicated in Canterbury through two factors—namely, the spread of underground-stemmed grasses, particularly old-man twitch (*Agropyron repens*) and creeping-fog (*Holcus mollis*), and the general unreliability of the turnip crop necessitating large acreages of autumn-sown green-feed cereals. Badly twitch-infested paddocks increase very greatly the amount of cultivation necessary, and seriously reduce the acreage that can be yearly dealt with by a team. The sowing of winter green feed cannot be spread over a long period, and in itself tends to throw back the cultivation work for winter wheat, often necessitating the more or less elimination of that crop from the programme. Again, even when a well-devised cropping programme has been arranged, two factors are likely to throw it out of balance; these are unfavourable weather conditions and alteration in market prospects for certain of the crops proposed to be grown. In the first case work becomes backward and cannot be overtaken unless a reserve power unit is available; and in the other case no flexibility in increasing or decreasing the area of a crop is possible unless there is flexibility in the amount of team-power available. So far as a stand-by team is concerned, it is clear that such provision is not feasible. Therefore, in order to perform satisfactorily the team-work on many Canterbury farms, contract teams must be employed, or a tractor purchased, if the work is to be handled at the right time.

Both the main speakers at Methven, Mr. J. Brown and Mr. W. W. Mulholland, were in complete agreement that under their particular conditions a single six-horse team could not cope with all the work

requiring to be done. In both instances a reserve unit had to be available. With Mr. Brown this was provided by the employment of a contract team where necessary, and with Mr. Mulholland the reserve power was provided by a tractor. Mr. Mulholland's general trend of argument was that a tractor in combination with a six-horse team did its work satisfactorily, enabled work to be brought up to date when weather conditions had thrown it back, allowed great flexibility in the acreage grown of any individual crop, and that when its purchase interest and depreciation costs were taken into account it was, if anything, cheaper to operate than the six-horse team. It must, however, be mentioned that he at no time suggested the advisability of eliminating his six-horse plant, only claiming that the use of a tractor to supplement the work of the team was sound practice.

Mr Brown's main contention was that farmers placed in a similar position to himself were better served by employing, when necessary, a contract team ra her than by purchasing a tractor. It is only fair to say, however, that it is only in certain parts of Canterbury that a cropping programme badly balanced so far as team-work distribution is concerned can be remedied by the employment of reliable utside teams just at the required time. Mr. Mulholland particularly stressed the point that it was the impossibility of securing auxiliary contract teams that first forced him to substitute them with the tractor.

The whole theory of the efficient utilization of the six-horse team rests on the fundamental fact that the team costs practically as much per day when it is idle as when it is at work. If a six-horse team deals with 100 acres a year the team costs per acre are, say, £5, whereas if it deals with 200 acres the costs are £2 10s. per acre. A tractor, on the other hand, does not decrease to any great extent the cost per acre of working the ground by increasing the amount of work it performs in any given year. This is due to the fact that a tractor has a more or less definite life represented by a certain number of working-days, and, apart from increased interest charges, it does not matter very much what period is covered before it is relegated to the scrap-heap. The point that a tractor does not "eat its head off" when not in use is one of the strongest arguments of its supporters, although perhaps unduly stressed at the Methven meeting.

The consensus of opinion at the meeting was that on the ordinary mixed farm of moderate to large size the tractor has a definite and valuable place as an auxiliary to the six-horse team. The ordinary mixed farm, however, is not the only one to which consideration has to be given. There is another of more importance in the South Island really than the mixed farm—namely, the sheep-farm which requires a large amount of both winter and summer supplementary feed in order to raise it above the status of a store-stock farm. Turnips and rape, together with sufficient oats to maintain the team, are the main crops required on such a farm. Now, a cropping programme consisting almost entirely of turnips and rape gives an extremely bad distribution of team-work during the year, and in consequence it was suggested by many speakers at the meeting that such cropping could be more economically dealt with by a tractor than a team.

With this view one must agree, provided the tractor is on the average as cheap to operate and as reliable as its supporters would

lead one to believe. A really liberal provision of summer and winter supplementary crops on many of the sheep-farms of the east coast of the South Island would result in a very great increase both in the stock carried and the quantity of fat mutton and fat lamb produced. At the present time this work cannot be done satisfactorily by the ordinary six-horse team, inasmuch as the necessary crops have to be sown at one period of the year and only a limited acreage can be dealt with. In consequence the cultivation cost per acre becomes far too high. With a tractor, on the other hand, it would appear reasonable to expect that, by working long hours during the limited period of the year when team-work is necessary, the acreage could be got in and the tractor put aside until required in the following season. If such a system were found to be practical there is little doubt, as already indicated, that many sheep-farms which at the present time grow no supplementary feed, and the products of which are at present sold in store condition, would become fattening-farms. Moreover, the soil-fertility of such farms would tend to rise, rather than fall as has been the case in the past.

Several speakers were insistent that for the breaking-in of badly twitch-infested farms the tractor was far more efficient than the six-horse team, and could for such a purpose do the work of two team units. If such be the case the tractor must find at least a temporary place on such farms. The writer has long been impressed with the fact that twitch is one of the important factors that has led to the comparatively low net returns from cereal cash crops in Canterbury. Under a proper rotation system the intercultivated root or forage crop represents the great cleaning-period of the rotation. This, however, is not so as a general rule in Canterbury, and the so-called cleaning-crop, by not being treated as a cultivated cropped half fallow, represents a renovating process for the further development of twitch. The result has been that much land is so seriously infested that an immense amount of work is necessary to clean it up. For this purpose the tractor appears to offer decided advantages over the team, always provided it is really efficient and economical.

The question as to whether contract tractor-work would not be more payable than contract team-work is one that naturally comes to mind. The contract team has in the past played quite an important part in Canterbury cropping, but is now rapidly disappearing. If tractor contract work is payable there is very considerable scope for the introduction of such contract cropping on quite a large scale, particularly in districts where one locality requires large areas of turnips and another large areas of green-feed cereals to be put in. By opponents of the tractor, however, the fact that contract tractor facilities have not gone ahead rapidly is always used as an argument to prove the superiority of the six-horse team.

The whole question as to the real position that the tractor should occupy in New Zealand farming is one that requires careful and expert investigation. In the past it has been viewed more from the standpoint of trying to prove whether or not the tractor would eliminate the farm team on mere comparison costs of operation, which factor often has no bearing at all on the matter. The discussion at Methven appears to show clearly that both forms of power are necessary in New Zealand farming. The time has therefore arrived to determine with some degree of accuracy just where and under what conditions the tractor should supply cultivation-power.

ASHBURTON EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1924–25.

F. E. WARD, H.D.A., Instructor in Agriculture, Christchurch.

A HIGH standard has been maintained on the Ashburton Farm during the past year, and in regard to certain experimental work improved methods have been introduced. The general policy has been to plan experiments so that differences can be measured with much greater certainty than has been the case previously. Mr. A. W. Hudson, Assistant Instructor in Agriculture, has specialized on this class of experiment, and has done excellent work, particularly in connection with wheat variety trials. The Overseer, Mr. J. G. McKay, again carried out the various farm operations in a very efficient manner, and from his reports this article is compiled.

COCKSFOOT FOR SEED.

This stand is now five years old, having been sown in October, 1920, in rows 24 in. apart. In previous years the paddock was stocked after the seed crop had been harvested, and the practice proved detrimental to the following season's crop. Last season (1924) the aftermath was not grazed, and the effect was quite marked, approximately 300 lb. of seed per acre being produced this year, as against 200 lb. last year. The rainfall of the previous year was the more favourable of the two, and there seems no doubt that the increase this season was due to the non-stocking during autumn. The area was cultivated during the autumn and spring. The soil in this field is very variable and not well suited to seed-production, but the indications are that cocksfoot under the wide-row inter-cultivated method on moderate Plains land should yield for a number of years highly payable crops of good-quality seed

BLACK SKINLESS BARLEY.

An area of 3 acres of Black Skinless barley was sown for seed-production. This crop should be of particular value to dairymen and other farmers in Canterbury requiring feed quickly in the spring or autumn, as for that purpose it is superior to any other green-feed cereal.

IMPORTED CROSSBRED WHEATS.

Twenty-four varieties of crossbred wheats from Dookie Agricultural College, Victoria, and four varieties from Canada were sown in short rows. A few of these showed promise, but further trial is necessary before any definite statement concerning their merits can be made.

WHEAT VARIETY TRIAL.

A carefully planned yield trial was carried out on fifteen varieties of wheat, most of these being selections from the original 180 varieties sown on the farm five years ago. Their yield and milling-qualities are being tested against the standard variety College Hunter's. The varieties were sown in long narrow strips, with

sowings of Hunter's next to each. The plots were wide enough to enable weighings to be compared with the controls adjacent to them on either side. A full account of the method of sowing and cutting will be published later. These trials will be conducted for three seasons before any stock of seed will be available for farmers' use.

Details of yields, computed by Mr. A. W. Hudson, are given in the following table :—

Yield of Wheat Varieties at Ashburton Experimental Farm, 1925 Harvest.

Variety.	Number of Plots compared.	Yield per Acre.			Odds.*	Quality of Gluten.	Strength of Flour.
		Variety.	Hunter's (control).	Difference in Favour of Variety.			
		Bushels.	Bushels.	Bushels.			
White-straw Tuscan ..	33	40·7	31·7	Plus 9·0	24,000	Good ..	Very good.
Red Fife	14	41·4	35·7	„ 5·7	24,000	„ ..	„
Major	34	41·6	36·1	„ 5·5	24,000	„ ..	Good.
Zealand	14	41·4	36·7	„ 4·7	24,000	„ ..	„
Queen Fair	34	40·8	36·3	„ 4·5	24,000	Fairly good	„
Marquis	34	37·2	34·3	„ 2·9	3,124	Good ..	Very good.
Jumbuck	31	33·6	30·8	„ 2·8	9,999	„ ..	„
Velvet Chaff	32	34·5	33·1	Not significant	5	Fairly good	„
Velvet Ngapara ..	34	38·4	37·8	Ditto ..	8	„	„
Snowdrop	34	37·8	37·6	„ ..	..	Medium ..	Medium.
Queen Fan	34	35·6	35·8	„ ..	..	Fairly good	Very good.
Yeoman	16	34·6	36·6	Minus 2·0	2,173	Good ..	Fairly good.
Essex Conqueror ..	31	31·3	36·3	„ 5·0	24,000	Fairly good	Very good
Turretfield Eclipse ..	34	25·1	34·9	„ 9·8	24,000	Good ..	Good.

* When the odds or chances in favour of any difference are less than 30 to 1 they are not regarded as being significant.

NOTE.—Particulars of gluten quality and strength of flour are from Mr. L. D. Foster's report on milling tests, 1924 season.

DREADNOUGHT WHEAT.

At the request of merchants and wheat-growers in North Otago an endeavour was made to procure a stock of Dreadnought wheat which could be sent back to Otago as certified seed. An area of 3 acres was sown at the Ashburton Farm, and Mr. McKay reports on it as follows :—

"This area was seeded to Dreadnought wheat procured from the Oamaru district, where the variety is much in favour, the intention being to rogue the plot, or part of it, of impurities, and supply that district with some reasonably pure seed. Owing to the very mixed condition of the seed, roguing was found to be impracticable in the standing crop, and careful selections were subsequently made from sheaf lots. Previous to sowing, the area was divided into three plots of approximately 1 acre each, and the seed treated as follows: Plot 1, formalin, 1 pint to 40 gallons water; Plot 2, no treatment; Plot 3,

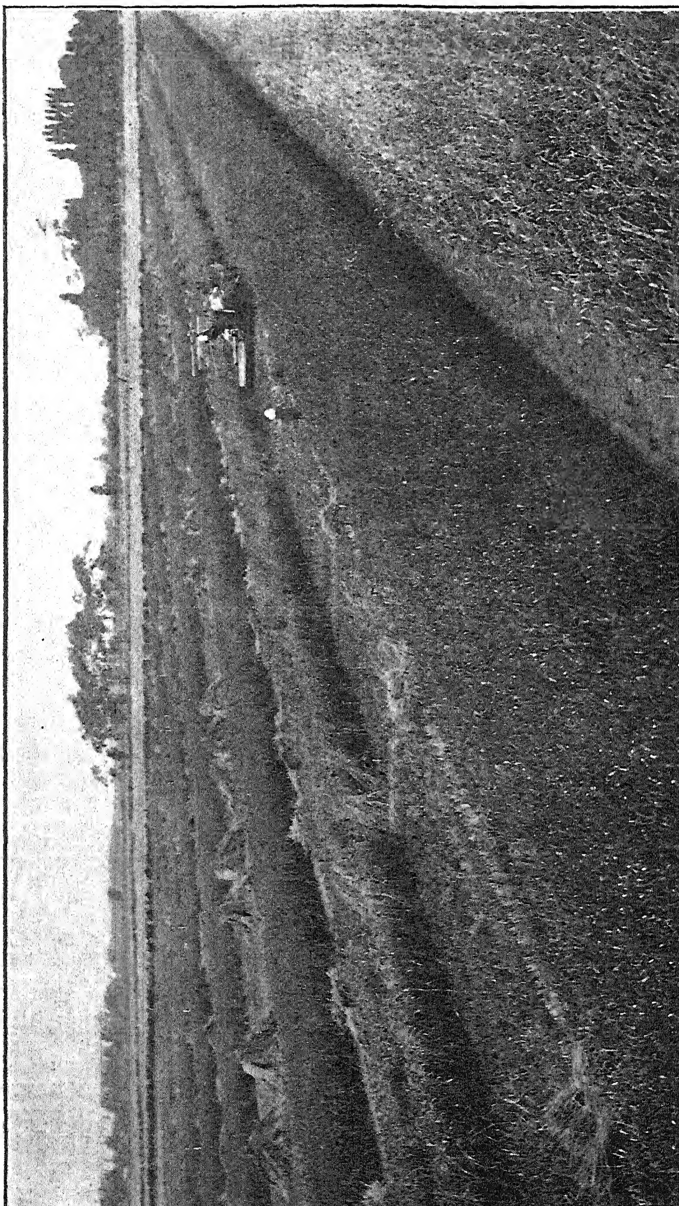


FIG. 1. HARVESTING WHEAT VARIETY TRIAL PLOTS AT ASHBURTON EXPERIMENTAL FARM, 1925.

The standing strips are the controls—College Hunter's—which matured later than most of the varieties.

[*Photo by F. E. Ward.*

copper carbonate, 2 oz. per bushel, dry. From counts taken in August it was found that the germination on Plots 2 and 3 was about equal, while on Plot 1 the germination was lower by approximately 135,000 plants per acre, or, roughly, one plant to 7 in. Apparently complete control of smut was obtained on Plot 3, while there was a small amount present on Plot 1. However, investigation was not sufficiently searching to make the trial definite. Quite a lot of smut was present in the untreated plot."

GREEN MANURIAL TRIALS.

The economy of ploughing in green-manure crops has often been discussed, but lack of reliable data has prevented definite opinions being formed. An experiment was arranged in which crops fed off, crops ploughed in, and bare fallow were in close proximity to each other and repeated three times. The crops ploughed in were mustard, Cape barley, crimson clover, oats and vetches, and rape. Fallowed land and plots of rape fed off were also included. The sowings were made in early September, with the exception of the rape, which was sown towards the end of November. The crops were ploughed in when ready. Mustard, being the first, was turned under on 13th November, 1924; and rape, being the last, was ploughed in on 1st February, 1925. The oats and vetches and the rape plots produced the greatest bulk of stuff to plough in. Mustard was quite the quickest grower, but, like Cape barley, produced only about half the weight of the first-mentioned crops. Crimson clover was quite worthless, fat-hen being the most conspicuous plant when the plot was ploughed. The whole field, comprising twenty-three plots, is being sown to oats this spring (1925), and numerous weighings from all plots will be taken next harvest.

GRAZING TRIALS ON SUDAN GRASS, JAPANESE MILLET, AND RAPE.

Season or soil conditions were evidently not favourable to Sudan grass, and the amount of feed produced was small. The sheep scoured badly when pasturing on the first growth of millet, particularly during the last days of their occupation. Although millet does well on medium Plains soils in Canterbury and has so far shown itself to be immune from disease, the growth of rape is equally rapid and its carrying-capacity greater. Three acres of millet and 1 acre of Sudan grass carried 220 sheep for six days. From 28th January to 3rd February, inclusive, 2·30 acres of rape carried 115 sheep for twelve days Regarding palatability, the sheep did not show a marked preference for any one of the fodders mentioned. A change is welcomed from rape to Sudan grass or millet, or *vice versa.*

LUCERNE-FED EWES AND LAMBS.

A pasture-paddock adjoining the lucerne stands was stocked from 1st June to 21st August, 1924, with breeding-ewes at the rate of 5·6 ewes per acre. Lucerne chaff at the rate of 2¼ lb. per head was fed in suitable feed-boxes as a supplementary ration. There was far less waste with the chaff than with the hay fed in the previous season. The ewes did very well, and further benefited by the green lucerne, which was ready for grazing on 21st August.

A 20-acre lucerne stand was divided into the following areas: No. 1, 3 acres; No. 2, 5 acres; and No. 3, 11 acres. Areas Nos. 1 and 2 were grazed throughout the season, whereas No. 3 was grazed in September, then closed for hay in November, and grazed again in the summer and autumn. The following is a summary of the stock-carrying: No. 1 area (4 acres) carried ninety ewes and ninety lambs intermittently for a total period of six weeks between 21st August and 30th November—that is, during fourteen weeks in the spring of the year the lucerne carried twenty-two ewes and their lambs per acre for six weeks. The same 4 acres carried fifty-three sheep per acre for one week in January, and gave a further lighter grazing in March. It is interesting to note that, with the exception of the first hay crop, this area has been grazed

FIG. 2. EWES AND LAMBS GRAZING WIDE-ROWED LUCERNE AT ASHBURTON EXPERIMENTAL FARM.

An advantage of wide-rowed lucerne for grazing is that sheep walk between the rows, and so keep the crop clean and graze it closer. Photographed in spring of 1924.

[*Photo by F. E. Ward.*

on every occasion since it was sown in March, 1921. The continued grazing has not detrimentally affected the stand in any way.

No. 2 area adjoining (5 acres) was grazed for a total period of nine weeks during the season, and carried an average of eighteen ewes and their lambs per acre during the period the field was stocked.

No. 3 area (11 acres) was left for grazing, and carried approximately thirty sheep per acre for three weeks in September, sixteen sheep per acre for four weeks in December–January, and twenty-three sheep per acre for one week in March. Between the September and December grazings a crop of hay, approximately 1 ton per acre, was taken.

LUCERNE MANURIAL TRIAL.

Portion of this lucerne stand (sown in 7 in. drills) was top-dressed with super, super and lime, and lime alone. The following was the average weight of green lucerne per acre: 2 cwt. super, 4·15 tons; 2 cwt. super and 420 lb. lime, 4 tons; 840 lb. lime, 3·59 tons; control (no manure or lime), 2·98 tons.

POTATOES.

Owing to the great need in Canterbury for pure seed of the more commonly grown varieties of potatoes, a small area was planted in Arran Chief and Bresee's Prolific, and care exercised in the roguing and selection of same. Other varieties, such as Manhattan, Australian Snowflake, and Dakota, were also selected. These supplies will be multiplied before being available for farmers' use.

SUGAR-BEET.

An area of about ½ acre was sown in 18 in. rows with seed obtained from Maffra, at 7 lb. per acre, and manured at the rate of 300 lb. of super per acre. Several weighings were made, and the crop averaged 15 tons per acre of topped beets.

PRESERVATIZED AND NON-PRESERVATIZED BUTTER.

EXPERIMENT IN RELATIVE KEEPING-QUALITY.

An experiment to ascertain the comparative keeping-quality of preservatized and non-preservatized butters held in cold storage, and subsequently at room-temperatures, was recently conducted at Auckland and Wellington, commencing in February last and concluding in June.

Seven pairs of boxes of export butter were used for the experiment, each pair being made at a different factory. Four of the factories were in Auckland and three in Wellington Province. The butter of each pair was from the same churning, and of the usual run of the factory's make. For the first box of each pair boron preservative had been used at the standard rate of ½ lb. per 100 lb. of butter (0·5 per cent.), and was of several different commercial makes in general use by dairy factories using preservative.

The butters on arrival at the grading-stores were graded, and then placed in cold storage and held there for approximately two months. They were then removed to the grading-rooms and graded at about weekly intervals for a period of up to four weeks, as shown in the accompanying table. The score points were allotted as total points, but the reduction shown represents the loss in points for flavour only. Total score points of 90 and over represent first-grade butter, and below 90 points represent second-grade The temperature of the grading-rooms ranged around 50° to 60° F.

It will be seen that on the average the preservatized butter held its flavour slightly better than the non-preservatized. The advantage,

however, was confined to only three of the comparative pairs, and averaged one point for each of the three. In three other pairs the reduction in the flavour was the same. In one instance the non-preservatized butter kept better by half a point.

From this experiment it would appear that the use of preservative has little or no effect in sustaining the keeping-quality of butter, either in cold storage or afterwards at room-temperatures.

Scores of Preservatized and Non-preservatized Butters.

(P., preservatized. N.P., non-preservatized. U.S., unsalted.)

Date of Grading.	Pair of Boxes—P. and N.P.	Score Points before Storage.	Score Points after Storage.					Boron Compound.	Total Reduction in Points.	Difference in Favour of P.	Difference in Favour of N.P.
			May 5.	May 12.	May 19.	May 26.		Per Cent.		Points.	Points.
1925.											
Feb. 19	P(US)	93½	93	92	91	88	..	0·15	5½	..	..
	NP(US)	93½	93	91	91	88	..	..	5½	..	..
,, 20	P	90	90	87	87	86	..	0·15	4	1	..
	NP	91	88	87	87	86	..	..	5	..	..
,, 23	P	91	90	86	86	86	..	0·08	5	½	..
	NP	92½	90½	87	87	87	..	..	5½	..	..
,, 24	P	91	91	90	88	87	..	0·20	4	..	..
	NP	92	92½	90	90	88	..	..	4	..	..
			May 25.	June 1.	June 8.	June 12.	June 22.				
Mar. 18	P	95	94½	93½	92½	92	90	0·17	5	..	..
	NP	94	93½	92	90½	89	89	..	5	..	..
,, 18	P	93½	91½	91½	91½	91	90	0·99	3½	1½	..
	NP	93	92	91½	90½	88	88	..	5	..	..
,, 18	P	91½	90	90	90	89	86	0·10	5½	..	½
	NP	92	90	89½	89	88	87	..	5	..	..
						Totals		..	..	3	½
						Less		..	..	½	
Net difference on seven pairs in favour of preservatized butter										2½ points.	

Summary of Reduction in Points.	Preservatized.	Non-preservatized.
Average reduction during cold storage	0·78	1·21
Average reduction in points after cold storage—		
(1.) From first to second grading one week later ..	1·42	1·64
(2.) From first to third grading two weeks later ..	2·00	2·07
(3.) From first to fourth grading three weeks later ..	3·00	3·64
(4.) From first to final grading	3·85	3·78
Average reduction in points during period of experiment ..	4·64	5·00

—*Dairy Division.*

Weights of Fat Sheep and Lambs.—The annual report of the Meat Board gives the average weight of stock treated at the freezing-works in the Dominion for the two last seasons as follows: 1923–24—Wethers, 55·9 lb.; ewes, 55·1 lb.; lambs, 34·1 lb. 1924–25—Wethers, 57·6 lb.; ewes, 57·2 lb.; lambs, 35·4 lb. It will be seen that the weights for 1924–25 are higher in every case.

CONTAGIOUS MAMMITIS OF COWS.

INTERIM REPORT ON TRIALS WITH REPUTED PREVENTIVE VACCINES.

Live-stock Division.

CONTAGIOUS mammitis affecting cows was again prevalent during the season of 1924–25, more especially in some parts of the North Island. During the official year ended 31st March last 1,613 milk-samples (more than double those of the preceding year) were received at the Wallaceville Veterinary Laboratory for examination. Of these, 40·2 per cent. were found to be from cases of contagious mammitis, 16·4 per cent. not definitely of the contagious form, and the remainder, 43·4 per cent., unaffected.

Two vaccines prepared in New Zealand and said to possess prophylactic value came into prominence during the year, and it was arranged that they be given exhaustive tests by the Department at the Veterinary Laboratory and in the field. Naturally, such experiments take some considerable time to bring to finality, and complete results are not yet available. In the meantime farmers will be well advised to exercise great caution in accepting interested statements and spending money on the vaccination of their cows. There is great risk in resting under a false sense of security, and thereby neglecting ordinary preventive measures.

Owing to the great interest taken in this matter and the demand for information, the Department has decided to publish results of the tests so far as they have gone. The following interim report by Mr. C. S. M. Hopkirk, B.V.Sc., Acting Officer in Charge of the Veterinary Laboratory, brings this information up to the beginning of the current month (September) :—

HAMILTON COMPANY'S VACCINE.

In January, 1925, the Hamilton Vaccine Company supplied the Wallaceville Laboratory with their vaccine for trial under experimental conditions. These differ from field conditions in that the disease is given artificially into known quarters of the udder, with definite quantities of milk from infected cows, or with definite quantities of a culture of the specific organism of contagious mammitis. That the dosage was not too large is shown by the fact that control cows—*i.e.*, cows not vaccinated—were able to throw off the disease just as quickly and effectively as the majority of the vaccinated cows.

During the trials hand milking by careful milkers has been resorted to, and the animals have been well fed and sheltered as well as rugged.

Following are details of the work up to date of writing :—

Experiment A.—Three cows were chosen from the Laboratory herd, each proved, by microscopical examination of its milk, to be free from mammitis. Two of these were vaccinated, and the third one left unvaccinated as a control. A month after administration of the final dose, when it is claimed by the company that vaccinated cows are at the height of their resistant power (immunity),

the two first cows were inoculated with mammitis-infected material —one with culture, the other with milk from an acute case of the disease. The control cow was at the same time inoculated in the same way in two quarters, one with culture, the other with the same milk-supply. All three cows contracted the disease.

Result: These cows were watched for some months until they dried off, and will be watched again after calving. The quarters infected with culture cleared up after a short time, with no advantage as regards time. The quarters in the vaccinated and control cows infected with mammitis milk remained infected for some months, but, before drying off, the control cow cleared up, leaving the vaccinated cow still affected with the disease.

Experiment B.—Six heifers were obtained from Moumahaki in March, 1925, and were chosen only after microscopical examination of milk from their quarters showed freedom from contagious-mammitis organisms. Their history also showed them to be free from the disease. These cows were vaccinated and kept from three to four weeks. Four were mechanically infected, while two were left to pick up the disease naturally, if possible, by milking along with affected cows. A control cow, not vaccinated, was also chosen from the Laboratory herd, she also having been proved free from mammitis at commencement of the experiment.

Result: Neither of the two vaccinated cows which were not infected artificially contracted the disease. The control cow cleaned up quickly, as did three of the vaccinated cows. The fourth vaccinated cow continued, until she dried off, to give organisms of contagious mammitis and inflammatory cells in her milk, although the milk itself was of normal colour. One of the three vaccinated cows, although apparently sound, flared up again, just when drying off, into an acute attack. The complete result of this experiment will be known when all these cows have calved, which will not be till the end of the year.

Experiment C.—Four more cows were obtained locally in July of this year, and three of these were vaccinated, the fourth acting as a control. These cows were proved to be free from mammitis in the quarters used, although one cow had been horned while in transit. All these cows contracted mammitis, both from culture inoculation and from injection of milk from an acute case of contagious mammitis, but it is too early to give further results from this test, except to state that the control cow was by no means the worst affected one of the batch.

Experiment D.—A fresh batch of eight cows, due to calve shortly, has been set aside at Ruakura State Farm for experimental work with the Hamilton Company's material. It will be some time before results can be obtained from this experiment.

AUCKLAND VACCINE.

For testing this vaccine four cows were procured locally in May last. Three were vaccinated as required by the proprietors of the vaccine, and a fourth was left as control. The cows were then left ten days in order to produce the optimum immunity, when they were artificially infected. All took the disease in each quarter inoculated. Some quarters were given cultures, others milk from acute cases of

the disease. The incubation period for those inoculated with culture appeared to be four to six days.

Result: At time of writing these cows are still in milk, and the latest examination shows that two of the vaccinated cows have cleaned up for the time being in all quarters. One vaccinated cow and the control cow are still affected in one quarter.

CONCLUSION.

Although the experiments are incomplete, in that it is advisable to wait a full season and until calving has taken place for final results, sufficient time has elapsed, so far as these trials are concerned, to show that vaccination with the two prophylactics reported upon has not given the expected immunity, and that cows vaccinated have no greater resistant powers to infection than those not vaccinated.

LOOSE SMUT OF WHEAT.

III. A COMPARISON IN GERMINATION AND PERCENTAGE INFECTION BETWEEN "FIRSTS" AND "SECONDS" SEED.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

A CONSTANT feature observed by the writer in severe infections of wheat by loose smut (*Ustilago Tritici* Jens.) is the large proportion of undersized grain harvested. When germinated in the laboratory these small grains from heavily loose-smut-infected samples almost invariably produce larger shoots and roots than grains of normal size. These facts suggest the possibility of some connection between size of grain and infection by the fungus; for instance, infection of the young grain in the head may prevent its full development, and, when germinated, the presence of the smut may stimulate growth in the young plant. Henning* claims to have shown experimentally that the small grains produce more smutted plants than the large grains, and Henning and Tschermak make use of this factor by advocating close sorting of the seed grain as a means of controlling the disease.

The present article records the results of a small experiment which, while throwing little light on the cause of these phenomena, shows clearly enough that no reliance can be placed on seed-grading as a means to control loose smut.

EXPERIMENTAL METHOD.

A hand-threshed sample from the same crop of Major wheat that was used for the experiments recorded in the two previous articles of this series† was separated into "firsts" and "seconds" by passing

* Liro, J. I. Die Ustilagineen Finnlands, I, p. 506, 1924. Helsinki.

† Neill, J. C. Loose Smut of Wheat: I, Seed-disinfection by Hot Water. *N.Z. Jour. Agr.*, vol. 29, pp. 177–187, 1924. Loose Smut of Wheat: II, Field Experiments on Seed-disinfection by Hot Water. *Ibid.*, vol. 30, pp. 167–174, 1925.

over a sieve having rectangular perforations measuring 2·5 mm. by 12 mm.; 62 per cent. by weight was thus classed as firsts and 38 per cent. as seconds. Samples of the firsts and of the seconds were then simultaneously disinfected by presoaking for six hours in water at 84° F., followed by dipping for ten minutes in water at 127° F. and drying in an air-current at 90° F. Two samples of 100 seeds each were counted out from the firsts and seconds, both treated and untreated, and, after weighing, placed to germinate in the laboratory. The remainder of the seed was sown two months later at Ashburton, at the same time and by the same method as described in the previous article. The results are given below in tabular form.

Description.	Laboratory Results per 100 Seeds.				Percentage Germination in Field.		Plants.			Heads harvested.				
	Dry Weight.	Germination (Six-day).	Weight of Roots and Shoots.	Weight of Remainder.*	First Count.	Mature Plants.	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	Per Seed sown.	Per Plant.
	Grms.		Grms.											
Firsts, untreated	5·33	99·5	7·33	6·76	58·0	55·2	221	45	20·4	1,056	174	16·5	2·6	4·7
Firsts, treated ..	5·40	99·0	4·24	6·72	55·2	50·2	201	0	0	1,057	0	0	2·6	5·2
Seconds, untreated	2·92	98·5	7·79	3·31	37·7	37·0	148	33	22·4	834	153	18·1	2·1	5·6
Seconds, treated	2·90	98·5	2·85	3·80	20·2	19·2	79	0	0	638	0	0	1·6	8·1

* Weight of residue (seed, &c.) after removal of roots and shoots.

SUMMARY OF RESULTS.

In the laboratory with untreated seed the seconds germinated more vigorously than the firsts, while after treatment the reverse was the case. This is clearly shown by the accompanying photographs taken just before counting, and is confirmed by the actual weight of shoots and roots developed.

In the field the firsts showed a much higher percentage of germination in both the treated and untreated samples than the corresponding seconds, though the generally low germination, due to the dry weather as explained in article II of this series, leaves this result open to a certain amount of doubt. The percentage of smut-infected plants and of smutted heads was slightly higher in the seconds than in the firsts, while the disinfection of the treated seed was in both cases complete.

COMMENT.

Though a slightly higher percentage of infection is shown by the seconds as compared with the firsts, the difference is so small that it can have no bearing on the problem of control, nor can it account for the stronger germination of the seconds in the laboratory. The experiment indicates, however, that it would be unwise to use seconds for seed even though they give good laboratory germination, since in the field—at least when conditions are unfavourable—the germination may be very poor. Under the conditions of this experiment—seeds

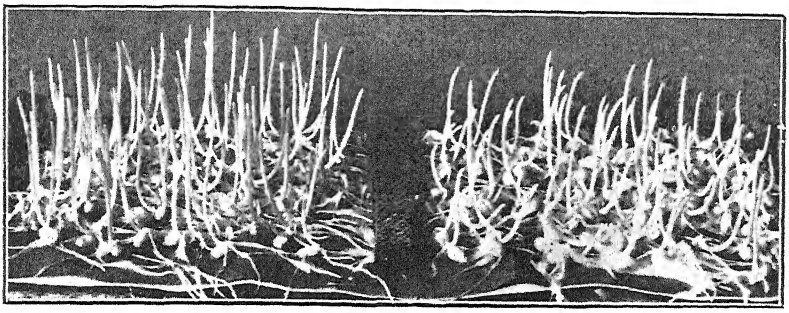


FIG. 1. SEED UNTREATED: SECONDS TO LEFT, FIRSTS TO RIGHT.

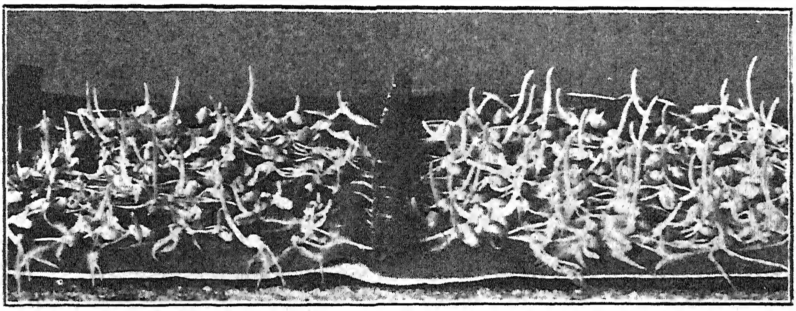


FIG. 2. SEED TREATED: SECONDS TO LEFT, FIRSTS TO RIGHT.

[*Photos by H. Drake*

sown 2 in. apart, with 12 in. between the rows—the increased tillering in the rows having a smaller number of plants tends to equalize the difference in yield. This is shown very well in the last two columns of the table, which give the average number of heads developed per seed sown and per plant harvested. The largest individual wheat-plant within the writer's experience occurred among the treated seconds in this experiment—it carried fifty-two grain-bearing heads—so that apparently size in the wheat-plant is influenced chiefly by environmental conditions subsequent to germination.

The disinfection treatment proved much more depressing to germination in the field when applied to the seconds than to the firsts, though in the laboratory it showed no difference.

Cultivation of Phormium.—Referring to land-drainage works, this year's Financial Statement remarks that of the remaining areas in the Hauraki Plains scheme much of the land will be developed for flax-culture, there being an increasing demand for suitable holdings for this purpose. Similarly, those portions of the Waihi Swamp reclamation area that are particularly low-lying will be devoted to flax-cultivation.

LIMING AND TOP-DRESSING EXPERIMENTS IN MARLBOROUGH.

F. W. Greenwood, B.A., Instructor in Agriculture, Blenheim.

For the benefit of those readers unacquainted with the province it is well to state at the outset that both from the geological and climatic standpoints Marlborough may be divided into two distinct districts: (1) That portion north of the Wairau generally known as the Sounds district, which distinctly resembles the North Island; and (2) that portion south of the Wairau, which climatically and geologically is distinctly South Island in character. It is my purpose to give briefly and summarily the results obtained from trials carried out under both types of conditions.

TRIALS AT KOROMIKO.

At Koromiko the conditions are distinctly of North Island type, the soil in the Waitohi Valley, where our experiments were conducted, resembling that of certain portions of the northern Wairarapa. The experimental plots are situated on Mr. N. Guest's property. The flats on which they have been conducted consist of a mixture of yellow clay and sandstone with an admixture of gravel. The plots were laid out on the system designed for use in all the instructoral districts of the Fields Division. Weights were taken from a strip the width of the mower's cut along the edge of each plot, four weighings being taken from each side of the boundary-line. In this way, through repetition of plots and a large number of weighings, the experimental error was to a large extent eliminated.

A 5-acre paddock was sown down in the following permanent pasture mixture in the autumn of 1924, and of this area 3 acres were used for experiment: 12 lb. cocksfoot, 15 lb. perennial rye-grass, 4 lb. Italian rye-grass, 3 lb. timothy, 4 lb. crested dogstail, 2 lb. white clover, 2 lb. cowgrass: total, 42 lb. per acre.

Lime was applied early in May, and top-dressing done in June. The trials conducted were as follows: (1) Lime *versus* no lime; (2) superphosphate and lime *versus* lime alone; (3) blood-and-bone *versus* super. Lime was applied at the rate of 1 ton per acre, manure at the rate of 3 cwt. per acre. No more lime is being applied in 1925, but top-dressing at the same rate is being repeated.

The spring of 1924 was a wet one, with the result that the hay cut in December consisted almost entirely of Italian and perennial rye-grass. The result of this is that cocksfoot and clover have been somewhat slower in establishing than they might have been in a drier season.

The resultant weighings from the Koromiko plots may be most clearly expressed as follows: If the weights obtained from the control plots are represented as 100, then weighings from limed plots equal 111; weighings from the plot where super alone used equal 113; super and lime, 131; blood-and-bone, 113.

Evidently lime used alone has shown just a suspicion of an advantage—that is, when an allowance of 7 per cent. for experimental

error is made. Superphosphate when used alone has shown but a slight advantage. Blood-and-bone has given practically the same result as superphosphate. The highest yield, however, has been obtained from the use of super with lime. It may therefore be said that the indications are very strong that under Sounds country conditions the addition of lime to superphosphate is a distinct advantage.

EXPERIMENTS AT SPRING CREEK.

The second set of experiments was conducted at Spring Creek, on Mr. W. H. Gane's property. Spring Creek lies a little to the south of the Wairau River, and is typically South Island in conditions. The soil on which the trials were carried out is a heavy alluvial loam. As in many other parts of New Zealand, the idea has been prevalent in this district that a mixture of perennial rye-grass and red clover

ONE OF THE EXPERIMENTAL PLOTS ON MR. W. H. GANE'S FARM, SPRING CREEK.
Left—no manure ; right—super and lime, showing abundance of clover.

lasts for only two or three years. Our experiments have been designed with a view to ascertaining just how long a rye-clover stand may be made to last under normal conditions of haying and seeding when liming and top-dressing have been carried out.

The typical history of such a paddock in the Spring Creek district would be somewhat as follows: An autumn sowing of perennial rye-grass and red clover is carried out in March. In late November of the following spring a hay-cut is made. This cut is generally considered to be the end of the rye-grass. The clover then, provided the season is favourable, comes away and is cut for seed about March. In the following season the processes of haying and seeding the clover are repeated. In the third season the haying and seeding may again be repeated, or the paddock may be ploughed up and some such crop as wheat sown.

In cases where Spring Creek farmers have top-dressed their clover the result has been somewhat as follows: During the winter browntop (*Agrostis tenuis*) has begun to make a pronounced showing. In the spring, however, in response to the top-dressing, cow-grass has again taken possession. The results obtained for the 1924–25 season may be thus briefly expressed: If the control plot is represented by 100, then lime alone equals 110, super and lime 246, and super alone 246.

It is evident from these figures that super used alone has shown a great advantage over the control—namely, 146 per cent. It is noteworthy that super and lime have given exactly the same results as super used alone. It would appear from this that the results obtained from the plot treated with super and lime combined may be due entirely to the superphosphate. Lime alone, it will be noted, has shown but a slight advantage over the control plot when a margin of 7 per cent. is allowed for experimental error.

In a further ten-plot trial with various manures at the Spring Creek area, all the manured plots being separated by controls, the results were as follows: Controls adjacent to super plot may be represented by 100, then super plot equals 170; controls adjacent to plot treated with super and rock phosphate, 100; then plot treated with a mixture of equal parts of rock phosphate and super, 129. The difference obtained through the use of super is again evidently by far the greater.

TESTS IN THE OMAKA DISTRICT.

A large number of Marlborough farmers top-dressed their pastures during the 1924–25 season, but the experiments privately conducted on Mr. H. Goulter's property at Sevenoaks, on the Wairau Plain, are of particular interest, as the results obtained from them go further to confirm those obtained at Spring Creek. Mr. Goulter's experiments were conducted on practically the same lines as those carried out by the Department, check plots being regularly interspersed among those treated with manure.

Without going into a detailed description the results, based on green material (first cut), may be summarized as follows: If no manure (check plot) be represented by 100, then blood-and-bone equals 64, basic slag equals 121, ammonia equals 507, basic super equals 467, sulphate of ammonia equals 277, superphosphate equals 365, and potash equals 361. It must be noted that the proprietary ammonia and potash top-dressings used both contain a large percentage of superphosphate.

The returns of dressed seed per acre from the second cut were as follows: No manure (check plot), 46 lb.; blood-and-bone, 89 lb.; basic slag, 39 lb.; ammonia top-dressing, 312 lb.; basic super, 225 lb.; sulphate of ammonia, 274 lb.; super, 408 lb.; potash, 368 lb.

The main point to note about Mr. Goulter's experiments is the fact that so far they have produced no definite evidence as to the efficacy of any manures other than super and ammonia for the production of green fodder, while super has most evidently been the main factor concerned in seed-production. These results very largely tally with those obtained at Spring Creek.

CO-OPERATIVE DAIRY COMPANIES AND THEIR SHAREHOLDERS.

PRINCIPLES OF CAPITAL CONTRIBUTION AND MILK-SUPPLY.

Address by ROBERT KENNEDY, M.A., LL.M., Solicitor to the National Dairy Association of New Zealand, at the Annual Conference of the Association, Hawera, July, 1925.

MY main purpose is to discuss in a broad and general way certain matters of the greatest interest to co-operative dairy companies. It will be my duty to point out that some of the foundations of our great co-operative scheme are not so solidly laid as many have supposed, nor so adequately protected by the law as we have all desired. I do not mean that we need be alarmed because we have problems constantly arising, or, indeed, because we have, in all companies, shareholders who have recourse to the Courts to decide their problems. That is really inevitable. That is really only proof of the magnitude of the dairy industry, and its changing conditions. These problems, too, arise only because our shareholders and directors are human.

But most of our difficulties arise from the enormous changes and developments which have been made in the industry. There must have been few who were dairying between 1880 and 1890 who even dreamt of the pre-eminent position of dairying in 1925. Who would have dreamt of the costly and efficient factories of to-day, of the space over which factories now operate, of our transport by land or river or sea, and of our varied associated interests?

This is nowhere more apparent than in the constitution of the early companies. Every company is founded on a document called its memorandum of association. That document is its warrant or charter. That document determines what its business is and what it may do. Companies are not like individuals. You and I may engage in almost any form of activity, and carry on any kind of business; but not so a company. A company has power to do only what its constitution allows it to do And many of the charters or warrants of the older companies are so worded that the companies could not do all that they, in recent times, desired to do. Many of the companies had not power, for example, to take shares in shipping companies or in transport companies or in boxmaking companies, or to run stores. Such companies have had to go to the Courts to get additional power. I venture to think there are few of the older factories which did not have to have their powers enlarged.

Nowadays, in the light of the past, we know what to do, and if you look at the memorandum of your company you will find it gives you power to do almost anything. One of our old Roman lawyers used to define the science of law as the knowledge of all things, human and divine. We who now follow the law do not profess to tell you all things divine, but I do recommend you, if you want to find a definition of all things human, to see the modern charter which prudent draftsmen give to any new company.

We have become, however, in New Zealand so accustomed to co-operative dairy companies that we are inclined to forget that our co-operative associations might have taken other legal forms. Dairy-farmers could not very well have carried out their intentions by merely forming a partnership. Death, of course, dissolves a partnership ; but the great difficulty is that by law large partnerships are illegal. Ten is the maximum number of partners the law will allow A partnership of, say, twenty is illegal and may not continue.

The founders of the industry, then, had to adopt some other form of constitution than partnership, and they generally adopted the form of constitution of a company. In England and Ireland, however, you may be interested to know, most co-operative associations are not ordinary companies, but what are called industrial and provident societies. In New Zealand, however, the obligations of a shareholder in a co-operative dairy company are, in practice, conceived to be very like those of a partner. The obligations of a partner are to be just and faithful to his partners, and to " play the game " by them and with them. The obligations of a shareholder in a dairy company are, in my opinion, the same. He should stand by his brother shareholders in the common venture. If he has rights, so he has obligations. If he is entitled to have efficient management and to demand the maximum return, so it is for him to furnish the necessary capital and to stand by his factory. A co-operative factory is not working, like a commercial company, just for profit. It is the shareholder's instrument to take his milk, and treat it and dispose of it to the best advantage. This is doubtless but a statement of simple truth to you.

I conceive, then, that the two principles on which the co-operative movement has been founded in New Zealand are—(*a*.) Every shareholder shall contribute to the capital of the company in proportion to his use of the factory. This provides the factory with funds. (*b*.) Every shareholder shall supply all his milk to the factory. This supplies the company with material.

CONTRIBUTION OF CAPITAL IN PROPORTION TO SUPPLY.

The first principle—namely, that every shareholder must contribute capital proportionate to his supply—will now be dealt with. If I have a large herd and a large supply I make a large use of the company's factory, and must take up more shares. If I have a small herd and make but a small use of the factory, then I need make only a small contribution. The essential thing is shareholding proportioned to supply.

In the early days the basis was one share one cow, and one cow one share. But time changed the demands of the industry, and the requirements of companies changed too. In place of a cow you substitute one share for 150 lb. of butterfat, and so on.

Here also change has come. Your herds improved, or you needed more capital, and you changed your basis. As time went on your plant became more costly and complex ; you had dual plants, or you installed pasteurization plants, or your old plant was out of date and you had to put up a new factory. How, then, did farmers and their advisers provide for this ? Rather, how did farmers provide for this ? I say, " farmers," because I have reason to believe the first suggestion of the

method adopted came from farmers rather than from their advisers. The practice arose of providing in the articles of association of the company that a supplier must hold one share for one cow, or one share for every 150 lb. of butterfat. If he did not take up shares, then shares might be allotted to him. The scheme went on for years. Some lawyers may have had doubts about it, but it was never challenged, and it worked on the whole remarkably well. A supplier paid for shares by deduction. The basis was not higher than necessary, because the rule applied to all shareholders. If you bound your neighbour thereby you bound yourself. What was good enough for your neighbour was good enough for you.

Some may ask, Why did not the farmers and directors take no risks, and get each shareholder to sign agreements with his company? That is really a counsel of perfection. I should myself answer any person who put such a question by saying, Have you ever tried to get signatures from farmer suppliers? You will know just as well as I do how easy it is to get signatures! Is there anything that a farmer distrusts more than an agreement? How are you going to get the signatures of farmers where your factory operates over large areas? The directors of the co-operative companies have had to be sensible and take what they could get. Moreover, it appeared so simple to provide in the articles of association what shares suppliers should hold

Then came the famous Macdonald case, which arose near this town (Hawera). It was felt by the National Dairy Association, and I think rightly, that that decision struck a blow at the security of co-operative dairy companies. The decision in that case has, as you can imagine, been much discussed in legal and dairy circles.

This much can be said with certainty: you cannot compel a shareholder to take additional shares in a company merely by altering the articles so to provide. But the serious aspect of the decision was this: it showed that the attempt to use the articles of association to do the work of contracts had failed. Thenceforth, if you wished to be safe, you would take some form of express contract from the shareholder. Of course, once the position was known it was possible to provide for the future. But what of the past? Mr. Macdonald was not bound to take the shares allotted to him; how about similar suppliers in all your companies? Could they say, "It is true we supplied, it is true we have had the services of the company, but nevertheless we decline to take the shares you have allotted to us"? If suppliers had said, "We have had the benefit of the services of the company, but we decline to pay the cost and take our shares," you will see what a momentous issue was disclosed. Companies had financed on the strength of shares allotted; banks had advanced on the security of uncalled capital.

Could, then, the shareholder, after Macdonald's case, say, "I repudiate those shares; I will not have them"? It was eminently desirable that all uncertainty should be removed. That was done by the passing last year of the Dairy Industry Amendment Act, 1924,* which was a Government measure founded on a Bill I had, with others, the honour of drafting for the Association. All these allotments in the

* The full text of this Act was printed in the *Journal* for December, 1924.

past, made in conformity with the articles, and made in good faith and acted upon, were validated. The uncertainty which existed both before and after Macdonald's case was removed. That measure was both necessary and just, but it dealt only with the past. It was a validating measure only.

Can you allot further shares to shareholders in the future? All that can be said is that if you want to be quite safe you must go back and make express contracts with the supplier. You may get a new supplier to sign a special form of application embodying an agreement to take shares allotted under the articles. You may get a transferee of shares to sign such an agreement as a condition of registering his transfer. If you can establish a contract in terms of the articles you may allot the additional shares. There is no method by which you can change a basis of shareholding and retrospectively bind an unwilling shareholder.

I should have thought it fair that companies should be able to use their articles in the way in which they formerly thought they could. It is not probable than any minority would be oppressed by the alteration. Articles can be altered only with a three-fourths majority, and the will of three-fourths of a company is generally just. There is, however, the additional safeguard that an alteration of the basis applies to those who vote for it, and the majority cannot bind the minority without binding themselves. Personally I think the law should be so altered that companies could use their articles like contracts, and allot additional shares in conformity therewith to a supplier proportioned to his subsequent supply. I think it necessary that they should have power even to alter the basis of shareholding, provided adequate safeguards are given to prevent hardship and oppression, and provided the alteration operates only in the future, and to bind a supplier only in respect of his subsequent supply. If, of course, you can conveniently get agreements with each supplier, that is so much to the good. If in practice you find you cannot get that, then I think Parliament should be again approached for legislation.

It may be objected that the companies should build up reserves, and thus have available for contingencies the additional capital as and when required. This, no doubt, is a prudent course of conduct. I must point out, however, that there has been some competition between co-operative companies which has not been wise, and in the desire to have a large pay-out they have not accumulated adequate reserves, and some relief must be provided for them.

The fact must now be conceded that co-operative dairy companies have different aims from most commercial companies, and special provision should be made for them accordingly. A commercial company exists to make a profit, and shareholders embark their money in the venture for that reason. Co-operative dairy companies exist rather to provide a service for the shareholders. Shareholders require not dividends, but rather a service in the handling, treatment, and disposal of produce. It is right, I think, that such companies should be able to define the conditions on which they will provide the service—namely, on condition that shares allotted in the manner provided in the articles are accepted by the suppliers. Some recognition of the special nature of a co-operative dairy company was made in the year 1907. Since that date a co-operative dairy company registered as such has power to

compel and accept in certain cases surrenders of shares. No other companies have such power. Commercial companies may accept a surrender of shares only as a short-cut to a forfeiture.

SUPPLY OF MILK BY SHAREHOLDERS.

This brings me to the second principle of co-operation in the dairy industry—shareholders must be suppliers, and must supply all their milk. This principle was adopted when it was necessary to the establishment of a factory that the minimum amount necessary to work a factory be guaranteed. But it is as necessary for a large as for a small company to have continuity of supplies.

The method the early dairymen adopted was to provide in the articles that the shareholder should supply all his milk to the company. Some such provision appeared in most articles of association of companies in New Zealand, and for some years in particular cases the Courts found it established that there was a contract in terms of the article and enforced it. Those here who come from the Palmerston North district may remember the case of Gore Brothers against the Newbury Co-operative Dairy Company, and Walsh's case. There again you will see an attempt was made to make the articles of association do the work of express contracts.

This question was put to the test in Shalfoon's case The decision in that case was no great surprise. The Irish co-operative dairy companies had been fighting on the point for years. That you might not have expected; but it so happened they were fighting on this point, and eventually their disputes were carried to the House of Lords. The case is called McEllistrim *versus* Ballymacelligot, but as few of us can pronounce the latter name we generally call it "McEllistrim's case." All that that case decided was that a provision for supply, similar to that appearing in most articles of association of co-operative companies in New Zealand, is in restraint of trade, and void and unenforceable. In Shalfoon's case the article provided that the shareholder must supply all his milk to the company. The articles did not say where the factory or farm should be. If the factory were at Auckland and the shareholder at the Bluff he was bound, and the Court held such a requirement to be in undue restraint of trade and void. The Court in effect said, "There is no doubt the directors will act reasonably, but we have to consider not what they are likely to do, but what they have power to do." The case then showed in effect: (*a*) An obligation to supply milk lasting for life is unreasonable; (*b*) an obligation to supply unlimited as to space is also unreasonable.

This decision, then, showed that the obligation to supply imposed by the articles of most co-operative dairy companies was in its particular form void. But, more important than this, it followed that merely putting in the articles a provision binding a supplier to supply had no effect. If you wanted a supplier to be bound you had to get a special contract signed by him, or prove a contract in terms of the articles. This was highly important to companies, and the Dairy Industry Amendment Act of last year provided that, notwithstanding Shalfoon's case, the law should for a further six months be as dairymen had believed it to be.

But that provision has now ceased to operate. If you want to bind your shareholders it is prudent to get them to sign supply agreements. How are you to get these? Failing that, you may,

if you deem it necessary, get the Legislature to permit you to use the articles to compel supply, but such legislation must provide adequate safeguards to prevent hardship or oppression.

ACCEPTANCE OF FURTHER SHARES.

I will conclude by mentioning a matter of fundamental importance to co-operative dairy companies. The law should be declared that if a supplier accepts shares from a company with articles which purport to bind him to hold shares thereafter proportioned to his supply he should be deemed bound in contract on his supply thereafter to accept further shares allotted in conformity with the articles. This point should not be left uncertain. If it is the law now no harm can come of embodying it in express enactment; and if it is not the law now, then legislation embodying this principle is urgently demanded. In any event the principle is so vital and so just that to remove doubts and controversy in co-operative dairy companies it should be incorporated in an amendment to the Dairy Industry Act at the earliest available opportunity.

STRATFORD DEMONSTRATION FARM.

NOTES ON WORK IN 1924–25.

J. W. DEEM, Instructor in Agriculture and Supervisor of Subsidized Demonstration Farms.

GENERAL work at the Stratford Demonstration Farm during the year ended 30th June last continued much on the lines of previous annual periods. A further area was cleaned up and stumped during the season; the piggeries were improved, and a pressure water-supply installed permitting of reticulation to most of the paddocks.

PASTURES.

The pastures on the farm continue to do well under careful management and top-dressing, Fields 2 and 3 providing a very fine example of this treatment. These fields were put down hurriedly in November, 1918, in a semi-temporary pasture, with the intention of resowing in three or four years, but have done so well that they are being continued for the present. The same applies to other pastures on the farm, and up to the present it has not been found necessary to resow. The field in which a heavy clover crop was turned under is especially good.

It has been found that about 42 lb. of seed per acre gives excellent results, and the best pastures were sown with the following mixture totalling that weight: 12 lb. cocksfoot, 16 lb. perennial rye-grass, 4 lb. Italian rye-grass, 3 lb. timothy, 2 lb. crested dogstail, 3 lb. cow-grass, and 2 lb. white clover. Prairie-grass has been tested, but the amount of feed produced from it so far does not warrant its inclusion in the mixtures. Danish, Akaroa, and local cocksfoot have been tried for comparison purposes, but up to the present there has been no noticeable difference in the amount of feed in the different sowings. In white clover, colonial and imported wild white have been tested against ordinary imported white. The latter grows well for the first

season, but appears to thin out after one year, whereas the wild varieties spread out and thicken. So far the colonial white has been superior to the imported wild white.

The system of drilling in 1 lb. of Buda kale seed about the middle of November, then rolling with the Cambridge roller, and sowing the grass-seed on the rolled surface and covering with harrows, has given the best results on this farm.

Top-dressing.

Various fertilizers have been tested, and experience up to the present shows that the only ones that pay are phosphatic fertilizers. Of these, basic slag, basic super, and mixtures of lime and super continue to give the best results in the order named. Slag has been used for the past four years as a standard dressing and continues to give very excellent results. Last season kainit was tried with the slag on two different fields, but so far there has been no noticeable difference in the pastures, and the stock have not shown any preference for the area treated with kainit. The system followed on this farm is to top-dress with 3 cwt. of slag in the first year, and follow this up with 2 cwt. per year afterwards. Kainit is being further tested this year, also super, basic super, bonemeal, and Nauru rock phosphate, against slag.

ROOT CROPS.

These have consisted of turnips, swedes, mangolds, and carrots —various varieties being tested from time to time as they became available. In turnips, Lincolnshire Red, Red Paragon, Imperial and Hardy Green Globe continue to give the best results, although some other varieties have done quite well. Swede results previously have been somewhat mixed owing to the ravages of dry-rot. This year, however, there has been very little rot. Of the standard varieties, Grandmaster, Monarch, and Superlative have done best. No Vilmorin seed was available this year. Mangolds — Prizewinner, Red Intermediate, and White Sugar have done best in the order named. Of the new varieties tested, Orange Globe and White Knight have done well, the former being the heaviest crop on the farm this year. In carrots, Matchless White continues to produce the heaviest crop.

Following are the average weights of root crops per acre on this farm for the past seven years, the 1925 results being shown in parentheses: Mangolds, 45 tons 9 cwt. (47 tons 8 cwt.); swedes, 43 tons 4 cwt. (38 tons 11 cwt.); carrots, 36 tons 8 cwt. (41 tons 12 cwt.); turnips, 41 tons 2 cwt. (42 tons 1 cwt.).

As regards manuring, 3 cwt. per acre of basic super has given the best average results for swedes and turnips; and a mixture of three parts superphosphate, one part steamed bonemeal, and one part Ephos phosphate, at the rate of 5 cwt., plus 2 cwt. kainit or 3 cwt. salt, per acre, has given the best results for mangolds; and the same mixture less the salt and kainit, at the rate of 4 cwt. per acre, for carrots. Nitrogenous fertilizers have been tested from time to time, but the results have not warranted their regular use.

GREEN CROPS.

These have consisted mostly of oats, and oats and tares for feeding off and subsequent haying. Pea crops for summer feeding to take the place of turnips have also been tested. The preceding year's mangold

land was sown in three varieties of peas on 29th October, 1924. These crops were weighed on 22nd January last and gave the following per-acre weights of green succulent material, which was relished by cows: Canadian grass-pea, 10 tons 9 cwt.; Early Minto pea, 11 tons 17 cwt.; Grey Partridge, 12 tons 4 cwt. Portions of the two latter crops were saved for pig-feeding, and ripened fairly well.

Small quantites of kales and chou moellier have been grown from time to time with good results. In the past season an acre of chou moellier sown on 5th November was partly fed in May last, but a portion was left standing right through, and was in splendid feeding-condition at the beginning of August, and would to a great extent take the place of swedes. Chou moellier is not immune from club-root, but has great powers of resistance, and may be grown successfully where most crops of the turnip or kale family would fail.

LUCERNE.

The small trial plots have been continued, and, although the lucerne has done fairly well, the results are not sufficiently outstanding to warrant it being grown here on a large scale.

THE DAIRY HERD.

The returns from the farm herd, both per acre and per cow, are being gradually increased. This has been brought about by a certain amount of culling, combined with careful handling and better feeding of the cows and heifers. There is no question but that the feeding accounts for the major portion of the increased return. The following figures indicate the position:—

Year.	Butterfat per Cow. lb.	Butterfat per Acre. lb.
1919–20	221·1	60·8
1923–24	305·0	108·9
1924–25	327·5	121·3

No cows or heifers have been bought in during the last four years, replacements being made from home-bred heifers.

PIGS.

The value of the Tamworth-Berkshire cross for bacon purposes being recognized, three Tamworth sows were procured last year and crossed with a Berkshire boar. A good number of the progeny of this cross have been sold to farmers for breeding purposes. Recently a Tamworth boar was secured, and during the coming season a limited number of purebred Tamworths will be available for disposal to farmers.

GENERAL.

There is no doubt that the results obtained on this farm are being closely followed by a great number of farmers in Taranaki, and field-days are becoming more and more popular. During the year under review a large number of farmers and their wives visited the farm, and, apart from anything else, the exchange of ideas that takes place during these visits must result in a great deal of good.

Mr. Hartwig, who has been manager of the farm for the past four years, resigned at the end of the season, having decided to take up his residence in the Nelson District, and the Committee's appreciation of his faithful and efficient services may be here placed on record. Mr. W. J. Grierson was appointed to succeed Mr. Hartwig, and took up his duties early in July.

LIMESTONES FOR AGRICULTURAL USE.

NOTES ON SOME RECENT SAMPLES.

F. T. LEIGHTON, Analyst, Chemical Laboratory, Wellington.

DURING the past two years some 120 samples of limestone deposits have been forwarded to the Chemical Laboratory of the Agriculture Department by farmers and others interested. Included in these samples are a number which, while not all of the highest quality, are particularly suitable for application to near-by lands by reason of their soft or sandy nature, no plant or power being necessary to render them suitable for agricultural use.

Farmers are invited to send to the Chemist, Department of Agriculture, Sydney Street West, Wellington, samples of limestone deposits which they consider might be of value to their lands. Such samples, which will be examined and reported on without charge, should be taken from as many parts of the deposit as possible ; single small fragments are apt to give misleading results.

The following is a selection of the more useful samples received during the period under review, the number in each case being the Laboratory reference number of the sample :—

R 1177 is from Ruatangata West, Whangarei. This is a hard, white stone containing veins of calcite (crystalline carbonate of lime). It contains 81 per cent. carbonate of lime, and would be a useful source of agricultural ground limestone, though it would require a considerable amount of power for satisfactory grinding.

S 100–102 are also from Ruatangata, and are fairly hard limestones containing from 78 to 82 per cent. carbonate of lime.

S 755 is a friable limestone from Parua Bay, Whangarei. It contains only 48 per cent. carbonate of lime, and is therefore of very low grade, but as it would crumble readily under the influence of weather it might be of value as a dressing for soils in the immediate vicinity of the deposit.

S 357 : This is a fairly hard stone, of good quality, from Hokianga. It contains 80 per cent. carbonate of lime.

R 673 is a hard, red limestone from Kawakawa, Bay of Islands. It is of good quality (85 per cent. carbonate of lime), but would be rather difficult to grind without plenty of power.

S 231, from Raupo, Northern Wairoa, is a hard marly limestone of rather low grade, containing only 73 per cent. carbonate of lime, and is therefore not recommended unless the cost of a higher-grade carbonate of lime renders it of economic value.

S 549, from Redvale, Waitemata County, is also somewhat low (75 per cent.) in carbonate of lime. This, however, is a fairly friable stone which could be comparatively easily ground.

S 571 : This is a very soft carbonate of lime from Upper Waiwera, Waitemata County. It contains 77·5 per cent. carbonate, and would be a very useful deposit, as no crushing plant would be required.

R 921, from Ardmore, Papakura, Manukau County, is a hard, semicrystalline limestone of 93·5 per cent. purity. This is a stone of excellent quality, suitable either for "burning" to quicklime or for grinding to produce agricultural carbonate of lime.

R 187 is a shelly conglomerate from Pukearuhe, Waitara, Clifton County. It contains 69 per cent. carbonate of lime, but the presence of many siliceous pebbles would make grinding somewhat difficult and costly.

R 468 is from Okoia, Wanganui. This is a very friable calcareous sandstone containing only 21 per cent. carbonate of lime, but as no grinding would be required the deposit would be useful where it could be cheaply applied in quantity.

S 42 is a very fine shell-dust from Wanganui district, containing 89 per cent. carbonate of lime. This is a soap-works by-product from ground sea-shells, and would form an excellent dressing for soils requiring carbonate of lime.

R 781 is a semicrystalline limestone from the Tuhoe country (Urewera). It contains 96 per cent. carbonate of lime, and there is said to be a very large deposit in sight.

R 645, from Aritiki, Te Puia, Waiapu County, is a calcareous sinter containing 99 per cent. carbonate of lime. This form of deposit is of exceptional purity, and is usually of a very friable nature. Unfortunately, sinter deposits are frequently of small extent and do not warrant the installation of crushing plant.

S 369, from Kahukura, Waiapu County, is a friable, easily ground limestone of good quality, containing 81·5 per cent. carbonate of lime.

R 1064, from Puha, Waikohu County, is a friable calcareous sinter containing 99 per cent. carbonate of lime.

R 390–392 are hard limestones, containing 65 to 74 per cent. carbonate of lime, from Whenuanui, Ruawai, Cook County. They are of inferior quality as agricultural limestones.

R 1068 is an excellent, soft, calcareous sinter, containing 98 per cent. carbonate of lime, from Muriwai, Cook County. There is said to be a large deposit of this substance, which is of the highest grade.

R 735 is also a calcareous sinter from Gisborne. It is fairly soft, and contains 97 per cent. carbonate of lime.

R 655, from Waipukurau, is a friable limestone rubble containing 84 per cent. carbonate of lime.

T 93, from the same locality as R 655, is a fine limestone grit containing 92·5 per cent. carbonate of lime. It is of very high grade, and is excellently suited for application to the land without preliminary treatment.

S 43: This is a very clean, coarse, shelly grit, containing 96 per cent. carbonate of lime, from Hatuma, Waipukurau County. It would be suitable for application to land in the vicinity without preparation, but for commercial purposes it would be necessary to screen off the coarser material or to grind it more finely.

S 226 is a calcareous sinter from Waione, Dannevirke. It contains 87 per cent. carbonate of lime.

S 238 is a calcareous sandy deposit from Piripiri, Dannevirke. It contains 72 per cent. carbonate of lime, and could be applied without grinding. It would also be useful as a diluent for superphosphate or other manures on the farm.

S 373, a shell grit from Matamau, Dannevirke, contains 60 per cent. carbonate of lime, and, requiring no treatment, would be a useful source of lime for soil-dressing.

S 547, from Whetukura, Ormondville, is a soft carbonate of lime of very good quality. It contains 87·5 per cent. carbonate, and is suitable for application to the soil without crushing.

R 634 is a fine natural limestone grit containing 94·5 per cent. carbonate of lime. It is of very high grade, and was found near Makuri, Pahiatua. No mechanical treatment would be required before use of this material.

S 190 is a hard limestone rubble from Mungaraki, South Wairarapa. It contains 95·5 per cent. carbonate of lime, and is similar to the Mauriceville and other Wairarapa limestone deposits.

T 1–4 are from Pirinoa, Featherston, and contain 83 per cent. to 89 per cent. carbonate of lime.

R 720–725 are hard, semicrystalline limestones from Takaka, Nelson Province. They vary from 67 to 84 per cent. in content of carbonate of lime.

R 841 is a good, fairly hard limestone from Section 969, Block I, Punakaiki Survey District, Barrytown, Grey County. It contains 80 per cent. carbonate of lime.

S 221–225 are five samples from Koiterangi, Westland. These were all hard, grey limestones showing veins of calcite, and varying from 78 per cent. to 86 per cent. in carbonate of lime.

R 1067, from Hillersden, Marlborough, is a very pure (99 per cent.) semicrystalline carbonate of lime (marble).

R 651 is from Cheviot. It is a fairly hard limestone of medium quality, containing 79 per cent. carbonate of lime.

R 681–683, from Teddington, Mount Herbert County, are three samples of ground limestone containing 86 per cent. to 90 per cent. carbonate of lime.

S 80–81, from Albury, Mackenzie County, contain 80 per cent. and 79 per cent. carbonate of lime respectively. They are both white sandy stones, easily ground.

R 679, from Section 2, Otairo Block, Waimate Survey District, is a hard, white limestone containing 93 per cent. carbonate of lime. It would be an excellent stone for the production of either quicklime or ground carbonate of lime.

R 680 is a similar stone from the same locality as R 679. It contains 91 per cent. carbonate of lime.

S 259–264 are six samples of high-grade limestone of the Oamaru class, from Enfield, Waitaki County. Their carbonate-of-lime content ranged from 96·5 to 98·5 per cent. These would be valuable limestones for grinding or for "burning" to quicklime.

FARMERS' FIELD-CROP COMPETITIONS.

TARANAKI-WANGANUI DISTRICTS, SEASON 1924–25.

J. W. DEEM, Instructor in Agriculture, Wanganui.

FARMERS' field-crop competitions were conducted during the 1924–25 season in thirteen centres of the Taranaki-Wanganui area, new districts included being Okaiawa, North Taranaki, and Makirikiri. Owing to the wet autumn and other duties intervening, judging was somewhat late for some of the districts, and a start had been made to pit or feed off many crops that would otherwise have come into the competitions. This had the effect of reducing the number of crops actually judged. Further, the season was not very good for mangolds in some districts, and a considerable number of these crops were withdrawn before judging-day. This year judging was carried out by Instructors J. M. Smith and A. J. Glasson, and the writer. In most districts the standard of cultivation was well maintained, but in one or two there was a distinct falling-off, farmers representing that the season was too wet to allow them to clean their crops at the right time. Altogether 263 crops were judged, made up of—mangolds, 94; carrots, 63; swedes, 43; turnips, 16; lucerne, 41; and maize, 6.

Following the practice of past years, exhibits from the placed crops were staged at the Hawera Winter Show, where they made a very attractive and educative display.

MANGOLDS.

As already mentioned, the season was not one of the best for this crop, and the average yield per acre showed a falling-off as compared with the preceding year, the figures being 56 tons 18 cwt., against 65 tons 2 cwt., a decrease of 8 tons 4 cwt. The championship crops which won the Sutton Cup in their respective districts were those of E. Parsons, Waitotara (Wanganui district), Prizewinner variety, 90 tons 12 cwt. per acre; W. A. Guy, Matapu (South Taranaki district), Giant Orange Globe, 98 tons 13 cwt.; and G. H. Bell, Oakura (North Taranaki district), Jersey Queen, 69 tons 19 cwt. J. Dakers, Kaupokonui, was the runner-up in South Taranaki with a fine crop of Prizewinner which weighed out at 95 tons 2 cwt.

An analysis of the crops shows that in the thirteen competitions Prizewinner gained seven firsts, seven seconds, seven thirds, and three fourths; Long Red, one first, two seconds, and one third; Jersey Queen, three firsts, two thirds, and one fourth; Orange Globe, two firsts, one second, and two fourths. The latter variety was grown only in a few places, and promises to be a very good mangold for this part of the coast; its heavy top is an objection. Prizewinner was again the main variety grown, forty-seven crops giving an average of 57 tons 6 cwt. per acre; eleven Jersey Queen crops averaged 58 tons; seven Giant Orange Globe, 66 tons 1 cwt.; eight White Sugar, 55 tons 15 cwt.; and eight Long Red, 52 tons 4 cwt. The remainder of the crops weighed were mixed varieties.

Last year's general remarks (*Journal*, September, 1924) in regard to manures, date of sowing, seed per acre, and width of drills apply with equal force to the season now under review. Following are a few

particulars relating to the championship crops: W. A. Guy, Matapu, mangold-manure, 4 cwt. per acre; seed, 6 lb. per acre; drills, 24 in. apart. G. H. Bell, Oakura, basic slag, bone, and super (equal parts), 5 cwt.; sulphate of potash, 16 lb.; salt, 3 cwt.; and nitrate of soda, 84 lb.; drills, 28 in.; seed, 4 lb. E. Parsons, Waitotara, 3 cwt. super, 1½ cwt. bone, and 28 lb. potash; seed, 6 lb.; drills, 24 in.

There was a little heart-rot this season, but nothing compared to last year; the trouble was again mostly confined to the Globe varieties.

CARROTS.

The season was rather better for carrots than the preceding one. The roots in general were very sound and of fine feeding-value. The average yield in the competitions was 41 tons 19 cwt. per acre, against 38 tons 10 cwt. in 1923–24, an increase of 3 tons 9 cwt.

The varieties grown were much the same, about three-fourths of the crops being Matchless White. The heaviest crop of this variety weighed out at 71 tons 15 cwt., and was, moreover, a very fine, even crop of splendid quality. This was grown by Mr. C. E. Billinghurst, of Maxwelltown, who won the Cooper Cup for the best crop of carrots in the Wanganui district. The best crop of carrots in Taranaki was grown by Mr. H. Hoskin, Matapu, and weighed out at 68 tons 19 cwt. per acre; the variety was Barriball, and the crop was the most even and best-quality one the writer has ever seen. Another crop of Barriball grown in the same district by Mr. H. H. Giddy weighed 56 tons 9 cwt. per acre, and was also of splendid quality. There is, by the way, quite a good opening for any one who cares to specialize in the growing of genuine Barriball carrot-seed.

Analysing the main varieties grown, it is found that thirty-one Matchless White crops averaged 42 tons 17 cwt. per acre; four White Belgian, 43 tons 4 cwt.; and nine Sinclair Champion, 38 tons 11 cwt. Mr. H. Hoskin's crop was grown in 14 in. drills, with 3 cwt. of mangold-manure and 1 lb. of seed per acre. Mr. Billinghurst's crop was grown in 26 in. drills, with equal parts bone and super at the rate of 4 cwt., and 1 lb. of seed, per acre.

When judging the carrot crops in the Maxwelltown and Waitotara districts some very fine crops of the Guerande variety, which are grown for sheep-feeding, were seen. Mr. E. Parsons won the Waitotara competition with a crop of this variety which weighed 53 tons 2 cwt. per acre. Guerande is coming more and more into favour for sheep-feeding.

SWEDES.

The area under swedes on this coast has steadily decreased during the past few years, owing to the ravages of club-root and dry-rot. However, those who pinned their faith on swedes during the past year were mostly rewarded with good, sound crops, there being very little of those diseases in evidence. The twenty-six crops weighed averaged 39 tons 10 cwt., against the preceding year's average from thirty crops of 32 tons 19 cwt., an increase of 6 tons 11 cwt., in addition to which the crop was of high quality.

The main varieties grown are Grandmaster, Superlative, Magnum Bonum, and Monarch, with odd crops of Masterpiece, Crimson King, &c. Taking this year's results, Superlative and Grandmaster have shown the most quality, with Magnum Bonum next; Monarch also did well in central Taranaki. If anything, Grandmaster was most free from rot

The best crops were grown with 11 oz. to 14 oz. of seed and 2½ cwt. to 3 cwt. of manure per acre. No particular manure stands out as giving best results. Mixtures of super and bone (half and half), super and slag (half and half), also basic super and special turnip-manure seem to have given about equal results.

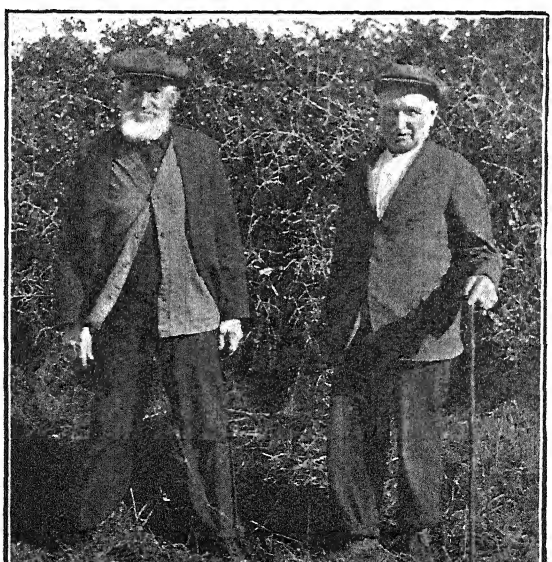
SOFT TURNIPS.

Only sixteen crops of soft turnips were weighed. They were of good quality, and averaged 40 tons per acre. Red Paragon came first, third, and fourth, with Hardy Green Globe second. All the leading crops were grown with 10 oz. to 12 oz. of seed per acre.

LUCERNE.

Keen interest was again shown in the judging of the lucerne crops, and some very fine stands were seen. Most of the placed crops gained over 35 points out of a possible 40. The winners in four mature-crop classes gained 39½, 39½, 39, and 36 respectively. It is interesting to note that in the Otakeho competition Mr. E. T. Bourke won the mature-crop class in 1920, 1921, and 1922 ; in 1923 he was placed fifth ; in 1924 he did not compete ; in 1925 he came in again, and won with 39 points out of a possible 40.

Nearly all the placed crops had been sown between 25th November and 15th December, and, with the exception of two or three that had been broadcast, they had been sown through every coulter of the drill. Seed ranged from 15 lb. to 25 lb. per acre. The placed crops, with one exception, had been given from 2 cwt. to 4 cwt. of phosphatic manure per acre when sown. This was either super, basic super, basic slag, or a proprietary lucerne-manure.



TWO FATHERS OF THE FIELD-COMPETITION MOVEMENT IN SOUTH TARANAKI.

Left — Mr. H. Betts, of Okaiawa (age 80) ; right — Mr. O. W. Dakers, of Kaupokonui (age 76). Both are among the keenest supporters of the competitions.

WINTER FEEDING OF MILKING-COWS.

RATION TESTS AT OTAKI SANATORIUM FARM.

SOME interesting feeding tests with dairy cows were carried out during the past winter at the Otaki Sanatorium and Hospital Farm, which supplies milk for those institutions. The farm land is poor and the pasture light, and the cows are given auxiliary food during several months of the year. In order to demonstrate the value of certain rations—concentrates in particular—as an aid to winter milk-production, six cows (which had not been in milk more than three months) were placed under test in pairs. The animals selected were the lowest producers of the herd, while the weather during the period of the test (June and July) was exceptionally severe for the Otaki district.

Following are particulars of the supplementary daily rations, milk produced for month, and butterfat tests :—

Pair No. 1.—June: Ration per cow—mangolds, 40 lb.; chaff, 6 lb.; hay, 10 lb. Milk-yield (two cows), 155·1 gallons. Test, 4·5. (Test at 30th May, 4·1.)

July: Mangolds, 40 lb.; chaff, 6 lb.; hay, 10 lb.; bran, 3 lb.; linseed-nuts, 2 lb. Milk, 161·3 gallons. Test, 4·1.

Pair No. 2.—June: Mangolds, 40 lb.; chaff, 6 lb.; hay, 10 lb.; bran, 3 lb.; linseed-nuts, 2 lb. Milk, 156·7 gallons. Test, 4·4. (Test at 30th May, 3·75.)

July: Mangolds, 40 lb.; chaff, 6 lb.; hay, 10 lb. Milk, 130·2 gallons. Test, 4·25.

Pair No. 3.—June: Mangolds, 40 lb.; chaff, 6 lb.; hay, 10 lb.; bran, 3 lb. Milk, 138·2 gallons. Test, 4·2. (Test at 30th May, 3·7.)

July: Mangolds, 40 lb.; chaff, 6 lb.; hay, 10 lb.; bran, 3 lb.; linseed-nuts, 2 lb. Milk, 145·5 gallons. Test, 4·3.

It will be seen that with pair No. 1 the addition of concentrates in the second month was accompanied by an increased yield of milk and a moderate fall in the test. In the case of pair No. 2 the withdrawal of concentrates in the second month was followed by a heavy drop in milk and a slightly decreased percentage of butterfat. With pair No. 3 a substantial increase of milk and a slight rise in the test accompanied the addition of linseed-nuts in the second period, although bran had been included in the ration of the first period. Commenting on these results, Mr. J. L. Bruce, agricultural adviser to the Health Department (which operates the farm), states: "They appear to support the conclusions of many practical men for many years past that for milk-production, both immediate and prospective (*i.e.*, a full yield from the commencement of the following season), the concentrates here used—bran and oil-cake—constitute a properly balanced ration when added to roots and hay." Particulars of the tests were reported by Mr. F. C. Melrose, Farm-manager, through Mr. Bruce.

THE REARING AND FATTENING OF GEESE.

F. C. Brown, Chief Poultry Instructor.

That the rearing of geese is not generally popular in New Zealand is borne out by the last census returns. These show that the total number of geese in the Dominion in 1921 was only some 46,000. Probably the chief reason why more attention is not given to the rearing of this class of feathered stock is because the demand here is almost confined to the Christmas season. If the demand for prime young goslings were extended over a longer season—and there is no apparent reason why it should not be—the breeding of geese for the table would be considerably encouraged. The Christmas gosling is usually looked upon as a choice table dish, but it is of equal value at other than the festive season. It is safe to say that the majority of families in New Zealand have never known the taste of gosling, while most of those who do know it only in connection with Christmas Day.

The breeding of geese may be conducted as a reasonably profitable side-line on farms, as the birds will live very largely on grass, weeds, &c., almost from the start. Another advantage is that little expense is required in housing-accommodation; indeed, in the greater part of New Zealand geese do not require housing at all. Even in severe climates an open shed to provide shelter during the winter months is all that is necessary. At that period the shed should be well bedded down with straw, and the birds enclosed by night. Although geese are great foragers, and if given their freedom during the day will pick up the greater part of their living, it is advisable to give them a grain meal at night, which will induce them to come home.

It is always an advantage to have a running stream for geese, in order to obviate the necessity of carrying water for drinking purposes. If profits are to be made, it is of great importance that all necessary labour and expense be avoided. Low-lying, damp pasture is the most suitable for geese, as green material is longer available on such areas in time of drought. Geese do well in an orchard, especially during the late season. Not only do they find much inexpensive food, but they are of a decided benefit to the orchard, as they help to destroy the insects, &c., that fall to the ground after the fruit has been gathered.

There are many varieties of geese, but the most desirable to keep in New Zealand are the Toulouse and the Emden. The average number of eggs laid is about thirty a year. It is a good plan to take the eggs away as they are laid; this will tend toward larger numbers being produced.

MATING.

Two or three geese should be mated with one gander. For best results the geese should be two to three years old and the gander two years. Progeny produced from younger parents seldom possess the desired constitutional vigour. Two or three groups of mated birds may be allowed to run together, providing they are peaceably inclined, but usually it is better to put each family by itself and as far apart as convenient. It will sometimes happen, however, that an old gander will mate with a single goose only. The stock birds should not be

allowed to get into an overfat condition during the winter. From a breeding point of view better results will be obtained if they are kept in a more or less lean condition. Grown-up geese are subject to but few diseases or ailments, and live to a great age, sometimes thirty or more years. Usually, however, after ten years they cannot be regarded as reliable breeding-stock.

Sometimes trouble is experienced in distinguishing ganders from geese. The gander has usually a thicker neck than the goose. It is said, if the geese are shut up in a shed, and a dog is put in, the females will lift their heads up and go to the back of the shed, while the ganders will lower and stretch out their necks, hissing all the time.

HATCHING.

Domesticated geese often prove to be poor sitters and mothers; therefore on the average farm it is best to use hens to incubate the eggs. A hen can cover from four to six eggs, according to her size. Geese-eggs may also be hatched in an incubator. Where the latter method is used it is a good plan to have broody hens ready to take the young ones when hatched. In this way they will not only do better than in a brooder, but there is also a great saving of labour in attending to the birds. Usually broody hens will refuse to mother young goslings unless they have been broody for, say, three weeks. The length of time required to hatch geese-eggs is twenty-nine to thirty days. Usually the hen has to mother the goslings for a short time only, as they grow so fast that they soon become quite independent. In order to assist the hatch it is a good plan to keep the soil under the eggs slightly moist, especially a little before they commence to pip.

After the goslings have been hatched twenty-four hours they should be removed to a good-sized coop. This should be placed on dry ground and in the shade, as hot sunshine is apt to have an injurious effect on the young birds. The coop is better without a wooden bottom, as the goslings are apt to slip on this and injure their delicate legs. The coop should have a wire-netting run attached, and the goslings confined in it for the first four days. After that they can be given their liberty to graze during the day. When a month old they may be allowed to sleep outside.

FEEDING.

When the goslings are thirty-six hours old they may be fed on equal parts of bran and pollard, moistened preferably with hot water. They should be fed three times a day, in quantity all that they will pick up in a few minutes. As they develop, and by way of variation in diet, boiled wheat, barley, and potatoes can be fed. As previously indicated, however, if the birds are to prove really profitable they must be induced to forage, and thus assist in keeping down the cost of production.

FATTENING.

A few weeks before being sent to market the inclusion of maize in the ration, and plenty of skim-milk to drink, will assist the birds to put on flesh. Goslings make rapid growth, and, provided they are well fed and managed, they can be made to weigh from 5 lb. to 6 lb. at four weeks and 12 lb. to 14 lb. when three months old. Goslings are better kept out of water until they are nearly feathered, but should

always have clean water before them to drink. Grit should also be in reach of them at all times.

In rearing goslings for the table, as in the case of table poultry or ducks, the production of a maximum amount of weight in a minimum of time is the ideal to aim at. After going to this trouble the producer should aim at selling by the pound weight, instead of the weak practice of selling by the pair. Poulterers are prepared to buy goslings by the pound if offered in a prime condition, but they look for something better than mere store birds.

WATER CONTENT OF EXPORT BUTTER.

RESULTS OF TESTING FOR YEAR 1924–25.

Dairy Division.

THE system of testing for water content a box of each churning of export butter in the lots received for grading, which was commenced in August, 1923, has been continued since as a regular part of the work of the Dairy Division.

During the twelvemonth ended 31st July, 1925, 145,780 samples of butter were tested, compared with 126,095 samples in the previous year. Of the 145,780 samples, 144,952 were found to contain water not exceeding the legal limit of 16 per cent., and 828 samples contained water over 16 per cent. Compared with the previous year the percentage of butter containing excessive moisture was 0·567 per cent. as against 0·938 per cent. The average water content of the butters over 16 per cent. was 16·384 per cent. The lots comprised in these churnings were returned to the makers for readjustment as regards moisture. The average water content of the butters not exceeding the legal limit was 15·035 per cent., as compared with 14·932 per cent. in the previous year.

A summary, in three divisions, of the percentages of butters with a respective water content of under 14 per cent., from 14 per cent to 15·5 per cent., and from 15·6 per cent. to 16 per cent., shows that there was a decrease in the amount of butters in the first two divisions and an increase in the third division. The quantity of butter represented was 70,216 tons.

No complaint as to excessive water in butter was received from overseas markets during the year. The system of testing evidently makes for a more uniform water content, and minimizes the risk of butter with an illegal content being exported. This is supported by the following note received from Mr. W. Wright, New Zealand Inspector of Dairy Products, London, under date 24th July, 1925 :—

" On the occasion of my visit to —— this week I had the opportunity of meeting one of the Board of Trade's Inspectors of foodstuffs. During our conversation he commented very favourably upon the uniform quality of New Zealand butter, specifying the question of moisture. Personally he feels that there is no need to take samples of our butter to test for water content, his confidence being gained

owing to the fact that analytical reports for some time past have been regularly returned as correct in every instance by the City Analysts."

The figures of the past year's work, together with those of the preceding twelvemonth, are summarized in the following tables:—

Table 1.—Butter tested for Content of Water, August to July, 1924–25 and 1923–24.

Year.	Butters containing up to 16 per Cent of Water.		Butters containing over 16 per Cent. of Water.			Grand Total of Samples tested.
	Number of Samples tested.	Average Water Content.	Number of Samples tested.	Average Water Content.	Percentage of Grand Total.	
		Per Cent.		Per Cent.		
1924–25 ..	144,952	15·035	828	16·384	0·567	145,780
1923–24 ..	124,913	14·932	1,182	16·380	0·938	126,095

Table 2.—Summary of Percentages of Butters of various Water Contents and Total Butter graded, 1924–25 and 1923–24.

Year.	Under 14 per Cent. Water.	14 per Cent. to 15·5 per Cent. Water.	15·6 per Cent. to 16 per Cent. Water.	Total Butter graded.
				Tons.
1924–25 ..	5·61	76·73	17·65	70,216
1923–24 ..	7·11	78·45	14·44	61,811

CULTIVATION OF FULLER'S TEAZLE.

REFERRING to the note on "Fuller's Teazles for Woollen-mills," published in the *Journal* for June last, the following are extracts from a communication by the Hon. G. M. Thomson, M.L.C., which appeared in the *Otago Witness* of 25th August, 1925:—

"I recently received from Mr. F. E. Ward, Instructor in Agriculture for Canterbury, a sample of teazles grown near Christchurch, and a packet of seed. The former have been submitted to one or two mills, and they compare quite favourably with the imported heads. Apart from the relative hardness and elasticity of the heads, the most important consideration is uniformity of size, and this can be secured only by selection from a considerable quantity. There is no room for cultivation in this country on a farming scale, but cottage-gardens with an acre or so of ground might grow a patch of teazles with profit. I have left some seed with Mr. F. Duthie, secretary of the Otago Agricultural and Pastoral Association, and with Mr. A. D. Miller, secretary of the Dunedin Horticultural Society, either of whom would, I am sure, be pleased to supply intending growers with a packet or two. From seeds sown this spring, heads would be mature in the autumn of 1926–27, as the plant is a biennial. I hope to obtain the offer of one or two prizes at the autumn horticultural show in Dunedin (1927) for the best sample of a hundred or more heads . . . The seeds are best sown in a seed-bed, in rows about 18 in. apart, and the seedlings, thinned out to about 2 in. apart, are left in the bed till autumn. They are then transplanted (dibbled) into well-prepared ground in rows fully 2 ft. apart and about 18 in. between the plants. Room must be left for hoeing, so as to keep the crop clean. During the second summer the plants shoot up like thistles—they belong to the scabious family—to a height of 6 ft. or more. Sometimes, but not as a rule, they flower in the first season. After flowering, when the heads are nearly dry, they are cut as they mature, with stalks about 10 in. long, and allowed to ripen in a shed or outhouse."

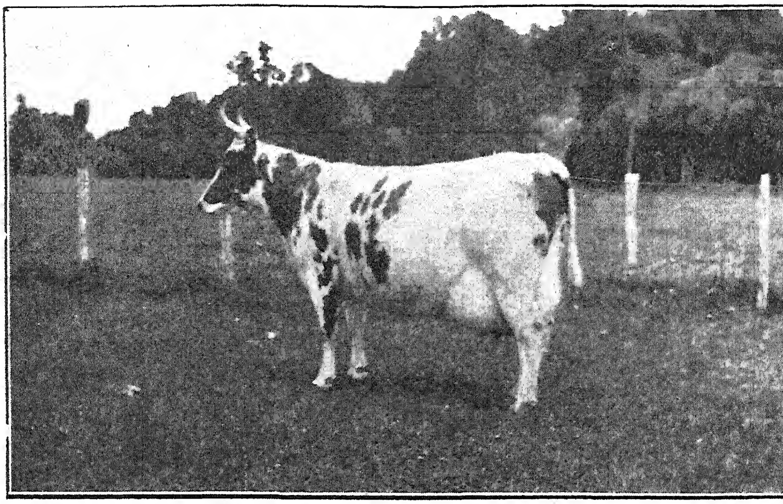
TESTING OF PUREBRED DAIRY COWS.

CERTIFICATE-OF-RECORD LIST FOR JULY AND AUGUST.

The following list gives particulars of the records of cows which received certificates during the months of July and August, 1925 :—

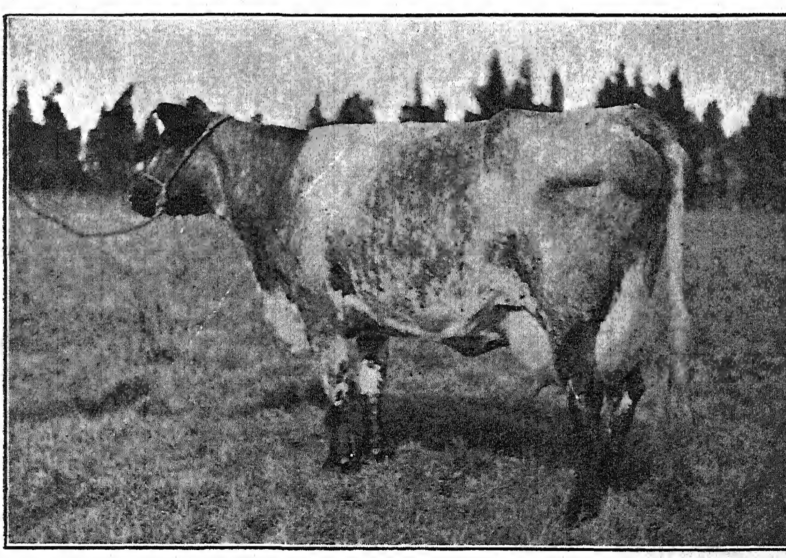
* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	JERSEYS.						
Junior Two-year-old.		Yrs.	dys.	lb.		lb.	lb.
Golden Senorita ..	A. Buchanan, Palmerston N.	2	3	240·8	328	7,362·3	461·60
Ivondale Golden Rainbow	P. J. Petersen, Brixton ..	1	350	240·5	263	8,191·9	454·89
Kelvin Lady ..	G. Buchanan, Paeroa ..	1	341	240·5	356	6,753·9	393·74
Nikorima Cherry ..	W. E. Wickham, Waitara ..	2	44	244·9	359	6,178·6	392·51
Grasmere Heiron ..	H. J. Berry, Kaupokonui ..	1	347	240·5	307	7,750·2	390·96
Carranza's Ruby ..	J. Klenner, Kaimata ..	1	287	240·5	365	6,840·9	377·44
Oldstead Maid ..	W. J. Wright, Puni ..	1	350	240·5	300	6,631·1	363·52
Sweet Lady ..	A. J. Harris, Bombay ..	1	239	240·5	326	6,057·6	354·92
Middlewood Joyce ..	E. E. Hale, Hamilton ..	1	193	240·5	306	5,566·6	354·09
Oaklands Jersey ..	T. King, Stratford ..	1	352	240·5	302	5,854·0	352·06
Hua Brook Modesty ..	T. H. Western, Bell Block ..	2	4	240·9	300	5,679·3	338·49
Rosedale Beauty ..	E. J. Adams, Puni ..	1	334	240·5	365	5,239·8	316·63
Lenora's Peggy ..	T. King, Stratford ..	2	17	242·2	320	5,158·5	306·92
Greenfield Lady Viola	T. King, Stratford ..	2	51	245·6	298	5,917·2	306·25
Wichenford Daisy ..	F. I. Washbourn, Timaru ..	1	204	240·5	314	6,219·4	303·48
Wichenford Picotee†	F. I. Washbourn, Timaru ..	1	238	240·5	365	4,857·2	303·26
Glyndyfrdwy Janet ..	H. E. Walters, Springdale ..	1	341	240·5	320	5,730·9	294·92
Springvale Superior ..	H. C. Bishop, Brixton ..	1	343	240·5	272	5,177·1	264·44
Tyrone Lass ..	R. J. Johnston, Runciman	1	118	240·5	282	4,568·9	248·81
Matchless Bluebell† ..	C. Stevens, Maungatapere ..	1	323	240·5	281	4,370·4	248·12
Ebor's Jean ..	A. H. Elicott, Hamilton N.	1	221	240·5	250	6,029·1	242·84
Hua Brook Welcome	T. H. Western, Bell Block ..	1	318	240·5	289	4,705·2	241·40
Senior Two-year-old.							
Ivondale Golden Lass	P. J. Petersen, Brixton ..	2	339	274·4	273	10,419·6	601·62
Thornycroft Choice ..	S. J. Bennett, Kaupokonui	2	280	268·5	365	9,893·2	527·99
Alfalfa Senora ..	A. E. Watkin, Takanini ..	2	263	266·8	365	9,247·9	527·58
Auroa Pretty ..	J. C. Duff, Auroa.. ..	2	325	273·0	365	9,073·6	512·23
Rockview Princess ..	W. H. Fitness, Rehia ..	2	306	271·1	275	7,943·4	478·88
Maori Lilium ..	G. Walker, Maunu ..	2	159	256·4	365	8,378·6	422·48
Jersey Lea Treeza ..	S. Bowker, Ihakara ..	2	358	276·3	360	7,168·4	421·53
Twylish's Carnation ..	F. J. B. Ryburn, Paterangi	2	281	268·6	329	6,400·5	319·09
Three-year-old.							
Fernaig Faustina ..	H. Peoples, Drury ..	3	143	291·3	365	10,732·7	659·07
Fox's Fancy ..	A. E. Watkin, Takanini ..	3	317	308·7	365	11,395·1	614·78
Jersey Brae Distinction†	T. Church, Te Rapa ..	3	265	303·5	358	9,183·8	612·16
Pukatea Gem ..	G. R. Bell, Waipuku ..	3	144	291·4	349	5,737·0	330·99
Ohio Grace.. ..	G. Walker, Maunu ..	3	307	307·7	346	4,993·0	311·30
Four-year-old.							
Holly Oak Silvery ..	G. R. and H. Hutchinson, Auckland	4	39	317·4	355	9,039·3	553·93
Middlewood's Mona ..	E. E. Hale, Hamilton ..	4	232	336·7	326	8,056·1	482·07



KATE OF EDENDALE (W. HALL, LEPPERTON).

C.O.R., 1924, in Ayrshire mature class: 10,168·6 lb. milk, 429·45 lb. butterfat.



JOYCE 3RD OF CORNWALL PARK (R. S. ALLAN, HATUMA).

C.O.R., 1925, in Milking Shorthorn mature class: 18,986·8 lb. milk, 700·12 lb. butterfat.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
JERSEYS—*continued.*						
Mature.		Yrs. dys.	lb.		lb.	lb.
Pamela's Linnet ..	W. J. Hall, Matatoki ..	5 188	350·0	354	12,845·4	651·41
Noble Girl	J. Nicholson, Manakau ..	8 101	350·0	365	11,966·3	588·14
Norfolk Park's Quickshine	W. H. Tippins, Opunake ..	5 292	350·0	266	10,596·7	550·90
Ensley Jem ..	A. E. Watkin, Takanini ..	5 302	350·0	312	8,489·6	527·19
Little Minnie ..	G. Hodgson, Whakapara ..	10 176	350·0	365	10,293·9	507·22
Sultan's Oxford Wena	G. R. and H. Hutchinson, Auckland	8 38	350·0	365	9,769·3	464·80
Fernaig Bo-Peep ..	A. E. Watkin, Takanini ..	10 221	350·0	299	7,650·8	430·14
Renoun's Carnation ..	F. J. B. Ryburn, Paterangi	7 321	350·0	322	9,903·4	427·78
Rewarder's Glory ..	A. Hazelton, Waihou ..	6 8	350·0	275	7,348·7	419·12
Glyndyfrdwy Betty ..	A. Hazelton, Waihou ..	5 324	350·0	299	6,900·5	364·83
FRIESIANS.						
Junior Two-year-old.						
Empress Pontiac Valdessa*	John Court, Ltd., Auckland	1 159	240·5	267	8,382·5	275·93
Miss Domino de Kol†	C. Boyce, Tatuanui ..	1 299	240·5	304	7,347·0	268·28
Senior Four-year-old.						
Princess Korndyke ..	W. J. Eames, Hunterville ..	4 257	339·2	365	14,681·5	482·46
Mature.						
Waipuna Ada* ..	John Court, Ltd., Auckland	6 267	350·0	332	12,689·9	421·26
Duchess O'Gowrie† ..	E. J. Betts, Okaiawa ..	8 293	350·0	313	13,097·0	366·26
MILKING SHORTHORNS.						
Mature.						
Needles Miss Massey A.†	J. M. Whitham, Glenbrook	Mature	350·0	323	11,690·2	445·15
Alice of Dungiven† ..	J. M. Whitham, Glenbrook	Mature	350·0	304	11,543·2	444·91

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.						
Corra Lynn Beauty's Jewel	A. Best, Bombay.. ..	2 62	246·7	365	6,182·5	406·00
Springdale Lady Oculist	J. A. Blake, Waipawa ..	1 359	240·5	304	5,194·2	257·61

—*Dairy Division.*

Massaging a Cow's Udder.—It is usual to massage the udder with a rotary movement. One quarter should be done at a time, commencing at the base and working down towards the teats.

Poisoning of Stock.—The Chemist to the Agriculture Department reports that an unusual number of cases of poisoning or suspected poisoning of stock were dealt with during the official year 1924–25. Several cases of poisoning by the improper use of sheep-dips came under notice. In one instance the use of a strong solution of an arsenical sheep-dip as a wash for lice resulted in the death of five out of six valuable plough-horses. Difficulty has been experienced in dealing

SEASONAL NOTES.

THE FARM.

PASTURES.

THE pastures will soon begin to show vigorous growth, more especially where fertilizers have been applied during winter or early spring. Towards the end of the coming month and during November they should be carefully grazed or gone over with the mowing-machine if there is any tendency to coarseness, patchiness, or seeding. If reasonably well controlled in this way pasture remains far more succulent and palatable as the drier months arrive. A few sheep are extremely useful on the dairy farm at this time to follow the milking-herd and clean up the pasture. The position is reversed on the rougher hill country, where cattle should control the coarser vegetation not suited to the flock.

Paddocks intended for hay may still be closed, during October and early in November. The later closing results in a greater development and higher proportion of clovers where these are present, but it is generally recognized that the early hay is finer in quality. Dairy-farmers should aim at making good provision of hay for winter use. There is far too much unbalanced feeding of cows at that season. Turnips are right when fed with good hay, but quite unsuitable alone.

SUMMER AND AUTUMN FORAGE CROPS.

Preparation of land intended for roots, rape, kale, and other forage crops should now be well in hand. In the earlier districts sowing may start any time after the first week of October, but farmers should recognize that in the colder and higher districts the seed is far better in bag than in the ground until the land has been warmed up and is in a condition to receive it. The extra time available is best spent in further tillage.

Soft Turnips.

Provided the conditions are favourable, all the white-fleshed varieties take about twelve weeks from date of sowing to readiness for feeding. Several new varieties have been tested during the last few years, but up to the present nothing has been found to excel Purple-top Mammoth, Red Paragon, Lincolnshire Red Globe, or Imperial and Hardy Green Globe. The best practice is to divide up the area, sow a small portion with Purple-top Mammoth, about twice the area of the latter with Red Paragon or Lincolnshire Red Globe, and the remainder with Imperial or Hardy Green Globe. These varieties may all be sown on the same date, and should be ready for feeding off in the order named. On new land soft turnips are best sown on the flat through every second coulter of the drill, using about 8 oz. of seed per acre. On old land, especially if weeds are bad, better results will be got from crops sown on ridges 24 in. to 28 in. apart, at the rate of 1 lb. per acre. The wide drills allow of intercultivation. Suitable fertilizers are super, basic super, mixtures of half super with either basic slag or steamed bonemeal, or proprietary turnip-manures.

Rape and Kales.

On clean land these crops are best sown on the flat, but where the land is weedy, ridging and intercultivation will be found to give the best results. Rape and kale when sown on the flat may be seeded at from $2\frac{1}{2}$ lb. to 3 lb. per acre; on ridges $1\frac{1}{2}$ lb. is ample. For chou moellier $1\frac{1}{2}$ lb. on the flat and $\frac{3}{4}$ lb. to 1 lb. on ridges is suitable.

Chou moellier has an advantage over most other crops of the Brassica family in that it is fairly resistant to club-root and may be grown on land where it would be very risky to attempt to grow rape or turnips. It takes longer than rape or Buda kale to reach the feeding stage, being slower to mature; but if not required for autumn feeding it may be left standing and fed during the winter and early spring.

Where these forages are being grown for cow-feeding, ordinary rape or turnip manures will be found very satisfactory. On the other hand, if the crop is being grown for lamb-fattening, pure phosphatic manures like basic super, or mixtures of half super and half Ephos, slag, or Nauru will give good results. A medium-firm crop will be found to fatten lambs better than a tall watery one.

From eight to twelve weeks should be allowed for the development of the rape crop, which, when intended for lamb-fattening, should be sown at a time that will bring it into a condition for feeding when needed for topping off the lambs. If a late-ripening crop is desired, one of the slower-acting phosphatic fertilizers should be used, the growing-period being thus prolonged.

Mangolds.

Among the best varieties of mangolds are Prizewinner, White Sugar, Jersey Queen, Giant Orange Globe, and Red Intermediate. The last named generally gives better results than Long Red, and is a much nicer root to handle. Giant Orange Globe is a comparatively new variety. It has a specially heavy top, and for this reason requires more room than Prizewinner, or else the root-development is retarded by the shading. Prizewinner, owing to the fact that it grows a smaller top than most varieties, may be grown in closer drills. Where trouble has been experienced with heart-rot it is best to grow white-fleshed varieties like White Sugar or Red Intermediate.

Mangolds should be grown on good, well-worked land, in drills 21 in. to 28 in. apart, so as to allow of plenty of horse cultivation. Sowing should be done at the rate of 5 lb. to 6 lb. per acre, and liberal manuring given. Mixtures of three parts super, one part Ephos or Nauru phosphate, and one part bonemeal, at the rate of 4 cwt. to 6 cwt., plus 2 cwt. kainit or 3 cwt. salt, per acre, will be found very suitable. The salt or kainit should be broadcasted and harrowed in before the mangolds are sown. Most of the proprietary mangold fertilizers are complete manures, and, used at from 4 cwt. to 6 cwt. per acre, give good results.

CEREALS.

Owing to the extremely wet conditions which have prevailed this year spring-sown cereal crops in Canterbury must necessarily be planted in soil which has not had the customary long period of winter fallow. The position is unfortunate, but the inevitable must be accepted, and

late oats and barley should be rushed in at the first opportunity. High-grade superphosphate is to be recommended generally under these circumstances in preference to slower-acting phosphates, whose usefulness may be very limited in the comparatively short growing-period which will be available.

In the North Island (or other districts of ample average rainfall) wheat may still be sown, provided that quick-maturing varieties such as John Brown or Major are selected. Major was sown at the Marton Experimental Area on two occasions in October, and crops equal to the earlier sown ones were harvested. October is also a suitable month for barley, both Cape and Black Skinless. For late oat crops quick-growing varieties such as Ruakura are likely to give the best results.

LINSEED.

Owing to unfavourable weather conditions a considerable area in Canterbury which would have been sown in cereals will now be devoted to linseed-growing. The advertised guaranteed price for next season's crop indicates that yields around ½ ton per acre should prove a profitable proposition.

The older practice of sowing 35 lb. of linseed per acre is giving way to lighter sowings. Recent observations indicate that sowings of from 25 lb. to 30 lb. are sufficient. With the heavier sowings the plants tend to produce seed-pods at their tips; with the thinner sowings a better development of seed-pods takes place down the seed-head. A marked improvement in variety has been effected by the introduction of French seed. Growers are recommended to secure these improved strains.

POTATOES.

The main crop of potatoes should be got in early during the coming month, as crops sown later than October are likely to suffer if a dry summer follows. On the other hand, a damp summer, with its accompanying prevalence of fungous diseases, calls for early development so that the crop may be as advanced as possible if these troubles do appear in January or February.

Care must be exercised to see that all seed is in good, sound condition, and where indications of disease are present any infected tubers should be discarded. Seed showing signs of scab is best treated by dipping in a solution made up of 1 pint formalin to 36 gallons water. Careful selection of sound seed is essential, because early and late blights and different forms of scab are introduced into the fields by unsound tubers.

LUCERNE.

Land intended for new lucerne stands should be kept stirred, with the idea of sowing at the end of October or in November. If the season has the appearance of being late it will be well to postpone the operation until the soil has warmed up sufficiently. Early sowings should be limited to clean land which has been winter-fallowed.

In Central Otago the process of ditch-cleaning and the repairing of field-race boxes should be rapidly completed in order to be in readiness for summer irrigation. Where land has been ploughed in preparation for sowing in lucerne it should be levelled out, after cultivation, with a home-made wooden leveller, an implement which

has been described in the *Journal*. Levelling surface irregularities greatly facilitates the even spread of water and reduces the labour involved in irrigation. The main sowing of lucerne should be delayed until the beginning of November, but the cultivation must be kept going in order to keep down the spring growth of weeds such as grasses or fat-hen. On warm slopes sowing may be done towards the end of October. The wide-drill method is not advocated for lucerne under irrigation. The seed should be sown broadcast or in the regular 7 in. drills, and lightly covered by a wire-netting or brush harrow. Generally speaking, soil inoculation is unnecessary in Central Otago.

—*Fields Division.*

THE ORCHARD.

SEASONAL SPRAYING.

LAST month's notes dealt with spraying up to the pink stage of blossoming on apples. The petal-fall or calyx stage comes next. It is now and at the fruit-set period that careful consideration is necessary as to the best procedure to adopt to ensure the best crop and to guard against black-spot.

Lime-sulphur is mostly used again at this stage, at 1–80, for apples, and many growers prefer to add 4 lb. of a sulphur paste, several forms of which are obtainable. On the tender varieties like Cox's and Dunn's, however, the paste is often used alone at 10 lb. to 14 lb. per 100 gallons. In weather favourable to the development of spot, the former is the more effective, in my opinion; but the latter is the safer of the two mixtures, and the grower must use his own judgment. Bordeaux, 3–4–50, can be used where spot is notoriously troublesome on susceptible varieties, but russeting must be expected at this period.

At the fruit-set stage the lime-sulphur can be reduced to 1–100, and consideration must now be given to other pests also. Codlin-moth, leaf-hopper, red mite, bronze beetle, leaf-roller, and mealy-bug will be waking up to perpetuate their species, and the resultant broods will commence to take toll of fruit and foliage unless combated by contact and poisonous sprays. Arsenate of lead, 1½ lb. to 2 lb. powder or 3 lb. paste, can be added after diluting with water and stirring in milk of lime from about 1 lb. of fresh stone lime—more is unnecessary—to neutralize the free amount of free arsenic likely to be in any arsenate of lead. Black Leaf 40, at 1–800, should also be added to the above mixture where leaf-hopper is troublesome. If the hopper is reached while in the nymph stage at the outset much worry will be saved later. Where mealy-bug is appearing this compound will also be helpful.

Most varieties of pears which are liable to black-spot can be sprayed with bordeaux, 3–4–50, at fruit-set; others can have lime-sulphur, 1–80, plus other materials, as for apples. The question of using a spreader with these sprays is one concerning which growers should use their own discretion. Last season my observations led me to conclude that it was unnecessary to use spreaders to produce clean crops, but I believe the spray certainly spreads better, and it eliminates blotching of the fruit when nearing the picking stage.

Stone-fruits will need careful attention for the control of brown-rot. Spray with lime-sulphur, 1–120, plus one of the sulphur pastes mentioned, at 4 lb. to 6 lb., and continue at intervals according to the weather and prevalence of the disease. Black and green aphis will also be appearing, and Black Leaf 40 should also be added to the foregoing compounds.

MANURING AND CULTIVATION.

Where manuring has not yet been attended to, no time should be lost. Phosphates should be on the land in time to be available as the trees start growth. Manure should not be scattered indiscriminately over the orchard. Some trees may not require any, but in most orchards some must be fed. Meet the needs of each tree according to its condition of growth. From 2 lb. to 6 lb. of phosphate per tree will be required, scattered over a good radius. The soluble nitrates and potash should be applied later as required, but not too great a dose of nitrate at one dressing. About 1 lb. per tree at a time is sufficient, repeated in a month's time where considered necessary.

Cultivation is essential, in the early part of the season especially. No opportunity should be lost to get a good tilth on when the soil is in a good state and weather suitable. A good start is the main thing. Once the land bakes down, as some soils will, it takes a lot of work to get it back into good condition.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Spraying: As the trees are now in active growth there will be little danger of damage to foliage by the use of an oil spray for control of scales and sucking-insects generally. Oil emulsion, 1–40, should be applied as soon as the young growth has hardened. Bordeaux, 4–4–40, or lime-sulphur, 1–50, should be sprayed when the petals have fallen from the bulk of the main spring flowering, as a preventive of verrucosis and grey scab. Several later sprays, at intervals of about three weeks, should be applied also to ensure the greater part of the continuous crop being clean. Bordeaux gives the best results for prevention of verrucosis, but requires the addition of Black Leaf 40 at 1–800; whereas lime-sulphur, while not giving quite such good results as a fungicide, certainly assists towards better control of young scales, mites, and thrip, although not more so than bordeaux plus Black Leaf 40.

Cultivation: Good cultivation at this period will assist towards keeping the rootlets (which are now growing freely) at a greater depth, and ensure a more equable moisture during summer.

Manuring: This season of the year is the best period at which to apply manures. For young trees—say, up to six years—2 lb. blood-and-bone and ½ lb. sulphate of potash may be applied with advantage now, and ¼ lb. nitrate of soda at two periods later in the growing season. For bearing trees 4 lb. blood-and-bone, 1 lb. superphosphate, and ½ lb. sulphate of potash is a good dressing. These fertilizers should be evenly distributed over the whole area rather than immediately near the trees, and harrowed or otherwise worked in.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CARE OF THE YOUNG STOCK.

THE end of the current season for hatching out chickens of any breed is now at hand. Birds hatched later than the middle of October seldom or never give a good account of themselves.

While the date of hatching determines to a large extent the future quality, there are other factors that must be considered if the young birds are to make sound development. The necessity of feeding the young birds well and managing them with every care cannot be urged too strongly. Their quarters should be kept scrupulously clean, remembering that the most dangerous parasites are not always visible to the naked eye. Shade is another matter which must not be neglected. It is quite essential for late-hatched stock, but also necessary for birds of every age. Do not neglect to keep the drinking-vessels clean and to shade the water. Grit, also charcoal, should be always available for the birds to pick at. Above all, see that succulent green stuff is supplied in abundance. In the first few months of a bird's life animal food should be sparely fed. The object should be to keep the bird steadily growing and not force it to maturity. The overforced bird that comes to lay in a sensationally short time neither gives the weight of egg nor the yield for the season that is given by one which matures in a natural way in, say, six months, when it possesses the desired constitutional vigour. Constitutional vigour is one of the greatest fundamental requirements in breeding heavy-producing stock, and there is no better way of promoting this than by allowing the growing bird to develop in the most natural way possible.

DUCK-REARING.

Hatching.—October is a good time for hatching ducklings for the renewal of the laying flock. Indian Runner ducks hatched then, provided they are properly fed and managed, may be expected to come into profit about April next. Ducklings are usually much easier to hatch and rear than chickens. The temperature during the period of incubation, at the level of the top of the eggs on the tray, should be 102° F. for the first week; from this on to the pipping stage 103°; and 104° when hatching. If the right degree of heat is maintained in the incubator, and the eggs are fairly fresh when set, the ducklings will commence to pip on the twenty-sixth day and hatch out on the twenty-eighth. Thus there is no need to worry if the eggs "hang fire" for, say, twenty-four hours, or even more, after the pipping stage. A common mistake is to open the incubator and attempt to help the young birds out of the shell before their full time to hatch. Many a promising hatch of ducklings has been spoilt from no other cause.

After being in the incubator for three days the eggs should be turned both morning and night. During the early stages they require very little cooling. The time it takes to turn them is all the cooling they require for the first week. From then on the time of cooling should be extended by degrees up to twenty minutes or even half an hour, while during the last week, if the weather is favourable, they may be left out much longer. The eggs should be tested, say, after the fifth

day, and the infertile ones taken out. Frequent tests should also be made for eggs containing dead germs. Such eggs rapidly decay and soon throw off bad odours, and unless removed from the incubator they are apt to spoil the hatching-qualities of the good eggs. A decaying duck-egg can often be detected without a tester—by the discoloration of the shell. To ensure a good hatch duck-eggs should be sprayed with water at a temperature of about 103° every morning after the fourteenth day. This may be applied with the mouth or a florist's fine spray. Do this after turning, and immediately place the eggs back in the machine. Do not cool after spraying; spray in the morning, and cool at night.

Brooding.—Ducklings should not be placed in a poorly ventilated brooder, or heavy mortality is likely to follow. Plenty of fresh air is undoubtedly one of the chief essentials in the artificial rearing of ducklings. As with chicks, ducklings should not be fed for thirty-six hours after hatching. During the first week the food may consist of equal parts of scalded bran and pollard, with some oatmeal or rolled oats added, together with 5 per cent. of fine grit. Feed four times a day as much as the birds will pick up clean in about ten minutes. At a week old the grit need not be mixed with the food, but it should be available to the birds at all times. Finely cut, succulent, green food, such as lettuce, young tender grass, &c., should be fed daily, but separately after the first week, while a little minced meat should be given, and increased by degrees as the ducklings develop. From then on feed equal parts of maize-meal, pollard, and bran.

Water should be given with the first meal, and from then onwards it should always be left in reach of the birds both day and night. It is safe to say that thousands of ducklings are lost annually by failure to observe this rule. When ducklings are confined in a brooder by night without water, and a heavy drink is given them before receiving their morning meal, fatal results are almost sure to follow. Ducklings affected from this cause will give every indication of being affected with a fit or sunstroke. They usually stagger and fall on their backs, with their eyes twitching, and death soon follows. If by chance it is found that the water-vessel is empty it is always a good plan, and especially during cold weather, to take the chill off the water before giving it to the young birds to drink. In this way the trouble described will be reduced to a minimum as against the giving of cold water, which often has the effect of chilling the birds, with fatal results. The drinking-vessels should be sufficiently deep, so that the ducklings can give their nostrils a good clean-out. If the nostrils are allowed to clog, the eyes become plastered, and generally the birds will present an unthrifty appearance.

Although ducks are waterfowl it is a mistake to compel young ducklings to sleep on damp or wet bedding; this is a common cause of leg-weakness during the brooder stage. To minimize this risk the drinking-vessels should be placed well away from the sleeping-compartment, in order that the bedding-material may be kept as dry as possible.

Marking.—The ordinary chicken-marker is unsuitable for marking ducklings, as the holes will invariable grow out. The best way of placing a distinguishing mark on a duck's foot for the determination of age, strain, &c., is to take a V-shaped piece out of the edge of the

web of the foot. This should be done with a very sharp knife, the foot of the duckling being held on a piece of smooth solid board during the operation.

Stampeding.—When ferrets, weasles, hedgehogs, &c., are about at night ducks of all ages are liable to stampede, with fatal results. Where trouble is being experienced in this way the only safe course is to enclose the birds by night in a roomy, well-ventilated shed. If this is not available it is a good plan to leave a light in the run at night. Where electric lights are not available any wind-proof lantern will do. A light not only tends to keep vermin away, but also gives the birds confidence that they are free from danger.

DEMAND FOR BRONZEWING TURKEY GOBBLERS.

Always at this time of year the writer receives many letters asking for advice as to where bronzewing turkey gobblers may be secured. He will therefore be glad to have for reference purposes the names and addresses of breeders who have such stock for disposal. It is safe to say that many breeders have a surplus of gobblers quite suitable for breeding purposes, and which they desire to sell as such, but by failure to advertise the fact such stock are frequently disposed of for table purposes at probably a quarter of the price that would be obtainable if their whereabouts were known to those who desire and realize the importance of introducing fresh blood into their flocks.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

FEEDING.

As advised previously, a strict watch should be kept on the food-supply. As the spring advances, this matter becomes of paramount importance. On no account allow the stores to dwindle. The queen's laying-powers are to a large extent automatic: as she is fed so will she lay, and when food is abundant brood-rearing will be in proportion. Do not forget that artificial feeding is invariably stimulating, and once undertaken must be carried out regularly and systematically. It is poor policy to fill a hive with brood and then leave it to starve. Spring losses are usually due to lack of stores, and are therefore preventable on the part of the beekeeper. Feed sugar-syrup only in the proportion of two parts of water to one of sugar, and place in the feeder while slightly warm.

PROVISION OF WATER.

In the absence of a natural supply, water should be provided. Bees require a good deal of water for brood-rearing throughout the whole season, and it often happens that numbers of bees are lost if water is not close at hand. Moreover, unless a supply is provided, bees often become a nuisance at cattle-troughs and by congregating round domestic supplies. Where a large number of colonies are kept it is imperative that the bees be well supplied. Many contrivances are used for the purpose of supplying water. "Simplicity" feeders make excellent water-containers, but they require to be filled frequently and occasionally cleansed. A good contrivance is to use a kerosene-tin

as follows: Having thoroughly cleansed the tin, punch in the bottom a hole about the size of a sixpence; through this hole pass a piece of clean rag so that the water will fall a drop at a time. Under the tin a container may be placed to catch the water, and this, if filled with sand, will afford an excellent watering-place for the bees. The supply can be regulated according to the requirements of the apiary. Bees prefer to take water from damp situations, and they may often be noticed in numbers sucking water from the ground where there has been any overflow. Feeders should be placed in a sheltered spot in the apiary.

FOUL-BROOD.

At all times when examining the combs a strict watch should be kept for symptoms of this disease. Beekeepers should never lose an opportunity of acquainting themselves with foul-brood in all its stages. At this season, if isolated capped cells are discovered in frames which contain no other brood, these should be treated as suspicious and subjected to the test for foul-brood. When, on opening the cell and inserting a sharp-pointed piece of stick, the dead imago can be lifted out complete in form, the beekeeper may conclude, if it is dry, that the case is one of starvation, and if moist, of chilled brood. If, however, the contents of the cell adhere to the point of the stick in a ropy, ill-smelling mass it may be concluded that the hive is diseased. There is perhaps no surer indication of the presence of foul-brood in the hive than the objectionable smell of the decayed larvæ. Beekeepers who once recognize this odour will have no difficulty in detecting the disease in that stage.

The last and most difficult form of foul-brood is the dry stage, and in this form it has baffled beekeepers of long standing. Only a careful examination can reveal its presence. The diseased larva, having dried to a scale, adheres to the lower side of the cell, and can be removed by scraping with a sharp-pointed instrument. If the aforesaid isolated capped cells on being opened appear at the first glance to be empty they will almost invariably yield a scale when closely examined, and the hive should be marked for treatment. There is a deeply rooted superstition among beekeepers that foul-brood can be detected outside by the odour, and the inexperienced are often misled by this statement, affirming that as no smell comes from their hives they are clean. When the odour of foul-brood can be detected from the outside at the distance of a few feet the hive is diseased beyond redemption. Fortunately, such cases are rare. For full instructions how to treat foul-brood see Bulletin No. 119.

TRANSFERRING BOX HIVES.

It is against the law to keep bees except in properly constructed frame hives, and offenders are liable to be prosecuted. Bees kept in box hives are of little value as honey-producers, and in addition the combs cannot be examined for disease.

The work of transferring can be carried out in the spring, or at any time during the season when brood is being raised. To lessen the work, choose a time when the bees are busiest in the fields. Prepare a new frame hive having ten wired frames fitted with foundation. Before commencing the operation put on a bee-veil, and then blow a few puffs of smoke in at the entrance of the box hive

to be transferred. Then lift it to one side and place the frame hive on the old stand, with entrance facing the direction which the box hive had faced. The latter is now turned upside down, and a box, preferably of the same size, is placed on top, mouth to mouth; then by drumming continuously for ten or fifteen minutes on the sides of the lower box with stout sticks the bees are made to desert the combs and take refuge in the empty box. When most of the bees have gone up into it the second box may be removed and the bees dumped on a bag in front of the new hive. Repeat the operation until all the bees are transferred. The box hive should be immediately removed to a place of safety and the combs cut out, each one being carefully examined in case the queen has not left the old hive. Occasionally she is the first to leave, but more frequently she is among the very last.

This method may be used where the beekeeper is absolutely certain that his hives are free from disease; but as a large proportion of box hives are more or less affected with foul-brood it is wisest to vary the method thus: In place of the full sheets of foundation, substitute 1 in. strips or "starters" of foundation, and leave the bees on these for four days. After this period the strips must be replaced by new frames containing full sheets of foundation. This latter operation will eliminate the disease. If the colony is free from disease, in order to save the healthy brood the latter may be fitted into empty frames and held in place with stout string or tape tied from the top to the bottom bar, and then placed in the new hive. In the course of a few days the string or tape can be removed, as the combs will be securely waxed by the bees. However, these combs cannot be used as extracting-combs with any satisfaction, as absence of wire would render them liable to break in the extractor.

It is not advisable for the tyro in beekeeping to attempt to save any brood from a box hive, as foul-brood in some stages cannot be detected except by an experienced apiarist, and by far the safest plan is to destroy all the combs from the transferred hive, thus ensuring that the frame hive begins its career free from disease. Care should be taken to destroy the starters on which the bees have been working during the first four days in the new hive.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

We are not yet through the showery weather and exuberant growth of spring; until this passes, and the drilled crops overspread ground between the rows, the surface must be moved in fine weather sufficiently often to keep weeds down. This doubtless is one of the most important factors in obtaining satisfactory crops. Not that cultivation should be deep at this season—in fact, usually it must be quite the reverse. To disturb the roots of growing plants at this time of the year is a serious matter. They do best now in a firm, well-prepared bed, free from the competition of weeds.

The skilful horticulturist who knows the nature and germinating-capacity of his seeds will have sown his crops in such a way as to make

the thinning of seedlings a light operation. It is, however, generally of first importance, and should be performed when the plants are small. Where it is purposed to grow a quantity of onions for pickling, it is sometimes done by omitting to complete the thinning of that crop.

Seedlings inclined, for any reason, to receive a check in their growth should receive attention. If they are neglected at such a time the harvest will be seriously discounted. A small dose of nitrate of soda, ½ oz. to the square yard, broadcasted along the rows would often meet the case.

The sowing of root crops, celery, and leeks should now be completed. Attention should also be given to the French and runner beans, marrows, pumpkins, and the remainder of the gourd family of plants, seeds of which should now be sown. Their palatability in both the fresh and dried state make them important and popular supplies during both the summer and winter seasons.

It is important to remember here the principle of rotation, for where heavy crops are grown at short intervals and removed from the land a frequent change in the kind of crop is necessary for chemical, mechanical, and pathological reasons. The suitability of the land and climate for the crop will not override this need of a change if the best results are to be obtained by the cheapest and best method.

In the colder localities the important winter-cabbage crops should be started now by sowing savoys, broccoli, Brussels sprouts, and kales in seed-beds. Sow them rather thinly in a piece of fresh, well-prepared land, and plan to have a piece of rich, well-drained ground available for planting them out permanently about the end of the year.

Planting out Half-hardy Crops.

The preparation of land for planting out half-hardy crops should now be completed. Early in October is the usual time for planting out in the warmer and northern areas, while early November is soon enough in the colder districts. Under this heading come kumaras, egg-plants, capsicums (peppers), cucumbers, melons, and tomatoes.

The careful hardening-off of such plants is important. Too often are large sappy plants taken from warm, humid conditions and planted in the open, sometimes in bleak, cold weather or dry, hot sunshine. The congested condition of the frames and seedling-houses at this season makes it urgently necessary to move them out as soon as possible, and with well-constructed cradles and covers, sheltered from prevailing winds, this important operation may be carried out successfully if the necessary consideration and attention are given to it. The boxes of young plants are best on the dry side just before shifting them out—a removal that should be made during fine, settled weather. For the week or so following, careful attention will be required to cover them on cold nights and during rough weather, and to give them the full benefit of free exposure when it is fine. In this way sturdy plants are produced by hardening them without checking their growth. If they have been planted wide a knife may be passed down between them both ways a week or so before planting out, and the roots thus cut will have time to callous before removal. Water the boxes well the day before planting out, and, choosing a dull day, plant rather deep and firm. If the land has been well prepared they have then an excellent prospect of yielding an early and satisfactory crop.

TOMATOES UNDER GLASS.

Under glass the tomato crop at this season frequently suffers from overwatering and excess of ventilation. It is to be remembered that the plant is half-hardy and prefers a dry atmosphere; also under glass it is grown for the sake of an early crop. To obtain this advantage the conditions under glass at this period must be consistently better than those outside. While abundant top ventilation is required at mid-summer to maintain a dry atmosphere when considerable watering has to be done and the house is filled with vegetation, no more watering or ventilation should be given now than is required to obtain steady growth. Further, if well or artesian water has to be used it is a decided advantage if it can be run into a tank for some time and slightly warmed before it is applied.

SMALL FRUITS.

New plantings of Cape gooseberries may be made now. A light, rich soil in a warm situation is to be preferred. The rows, running north and south, should be 6 ft. and the plants 3 ft. apart.

The mulching of strawberry-beds is not quite understood by some growers: the operation has two important results, among others. The mulch has the effect of maintaining that soil-moisture which is so necessary for this crop during the warmer months, so prolonging the cropping-period. It also keeps the berries clean of that grit that is thrown up by rains falling on cultivated ground. Inquirers recently have asked if old hay might be used for this purpose. Almost without exception when so used the result has been most disastrous, owing to the seeds of twitch and weeds establishing themselves in the land. The most convenient material probably is clean straw, and even this is best exposed to the weather before use, with the view of germinating any seeds it might contain. The mulch is best applied just as the crop commences to set, and is best preceded generally by an application of nitrate of soda.

Time should be taken at this season to carefully examine the breaks of small fruits for the commencement of any attack of disease. If such be discovered a remedy should be applied without delay. Many of these crops are seriously handicapped by fungus, scales, and other insects. A summer-strength bordeaux with arsenate of lead would benefit most of them at the present time, and where scale insects are troublesome a tobacco concentrate and soap solution would be beneficial. These applications should be made before the fruit sets.

TOBACCO.

Where a tobacco crop is being grown the seed-beds will need close attention now; it is important to put out good plants as early as the season permits. Where the seedlings are crowded, thin them carefully. During the latter half of the period in the seed-beds the plants usually receive the encouragement of fortnightly applications of liquid manure; ½ oz. of nitrate of soda, or rather more of sulphate of potash, in well-diluted solution may be applied to the square yard. Moderate-sized plants 2 in. to 3 in. high are best for setting out. Water the bed well before pulling them, and when pulled place them neatly, roots down, in a basket or tray and keep them shaded till planted.

In preparation for the plants the land where they are to be grown should receive what dressing of manure is to be given, well ahead of planting. In doing this it is to be remembered that the object is not to grow a gross, rank plant; only sufficient manure is to be given to grow a plant true to type and of good texture. For this reason manuring must be done very sparingly. Where a proper rotation is observed nitrates can be dispensed with altogether. Varieties grown here are usually spaced 3 ft. between plants and rows. Where a planting-machine is not available a marker may be used for larger areas.

HORTICULTURAL EDUCATION.

The young men of this country who have desired to qualify in some branch of horticulture have had a most difficult task, owing to the limited opportunities of practical training and the almost total absence of a suitable scientific and commercial course. The result is a comparatively low standard of attainment generally in a fundamental primary industry when compared with many other countries. However, the prospect has brightened considerably lately as a result of the report of the special committee on horticultural education submitted to the New Zealand Institute of Horticulture at its recent annual conference. The qualifications of the members of the committee give the best possible authority to the recommendations they have made. These were unanimously adopted by the conference. They lay down a definite course of training and examination, and an endeavour is now to be made to make the course available. The successful achievement of that object will be an immense advance on the present position, and cannot fail to raise considerably the general standard of horticultural craftsmanship.

Some people, and of a very practical nature too, have been inclined to discount the value of a thorough training, and to justify their opinion have quoted individuals of great ability who have attained their position by means of exceptional character and genius. Such instances are altogether too rare to be relied upon, and in most of the few cases which do occur are found the considerable limitations that are features of the type. Other men, while quite capable of carrying out most horticultural operations in a very satisfactory manner, lack the scientific and commercial knowledge to direct these operations economically and with a high degree of success. They fail to accurately readjust their methods to the ever-varying conditions, especially of the weather and market.

The fruitgrowing industry specially has suffered severely from a shortage of men with the necessary training to enable them to satisfactorily manage orchard estates. Those young men of industry and intelligence who avail themselves of the training suggested by the Institute will have an opportunity of overcoming such limitations, and the profession of horticulture and the general public should be great gainers as a result.

—*W. C. Hyde, Horticulturist.*

Roche Lime.—A correspondent asks the meaning of this term. Roche lime is simply burnt lime.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

POLLED ANGUS CATTLE FOR HIGH TUSSOCK COUNTRY.

"POLLED ANGUS," Fairlie :—

Would you kindly advise me how the Polled Angus compares with the Hereford as a beef breed; in suitability for high tussock country very liable to heavy winter falls of snow; foraging on such country; constitution and general hardiness; docility, size, and early maturity; suitability for crossing with either the Hereford or Shorthorn, and breeding purposes—that is, have they a sufficiency of milk when grazed on tussock country to rear good calves?

The Live-stock Division :—

In general, Polled Angus cattle compare well with the Hereford as a beef breed. They are good foragers in tussock country, have a good constitution, are generally hardy, and usually do their calves well. When reared on high country subject to heavy snows they are inclined to become smaller in size and slightly rough, and, unfortunately, they are anything but docile when bred under such circumstances. In fact, they become very wild, and, of course, they do not mature as early as when reared on better country. The Polled Angus breed is highly suitable for crossing with either the Hereford or the Shorthorn. Probably no better beef is produced anywhere than that from the Polled Angus-Shorthorn cross. Although the foregoing represents the general experience in connection with Polled Angus cattle, we have known of cases (where probably the tussock was inclined to be poor) when the breed did not do at all well and were replaced by Herefords, which did much better. However, Polled Angus cattle in general do quite well on tussock country.

MUSHROOM-CULTURE.

O. E. CLARK, Christchurch :—

I would like to know how far apart the mushroom-spawn should be planted in the hotbed manure under glass, and what size the spawn should be broken up into. Also, is it best to buy the spawn made here or import it from England?

The Horticulture Division :—

The pieces of mushroom-spawn should be inserted in the prepared bed at a distance of 9 in. or 10 in. apart, the pieces being about 3 in. long, 2 in. wide, and the thickness of the ordinary spawn brick. When examined a few days after planting, the pieces of spawn, if sound, will show a growth of the white mould-like mycelium. If this does not develop it means the inoculation has failed and the bed must be replanted. The best way to ascertain the respective merits of different brands of spawn is to put them to a practical test.

MIXING SUPERPHOSPHATE AND LIME.

J. P. J., Morrinsville :—

We are using 44–46 super with ground lime—half and half—but only mixing as we use it. Will the lime have a bad effect on the super, or will it be better to drill separately? High-grade super is sometimes difficult to drill, and by mixing with lime it runs very well. We are putting on 400 lb. per acre.

The Fields Division :—

The lime will not have any bad effect on the super, but quite the reverse. Evidence gained from field experiments, in addition to the experience of farmers, supports this. As you point out, the lime (which presumably is ground limestone), makes high-grade super run through the drill better.

"HAY TEA" FOR CALF-REARING.

E. CLARK, Tahora :—

Would you please tell me whether "hay tea" made from good, sweet hay is a good substitute for calf-meal and other patent foods for calf-rearing? Can it be used for comparatively young calves?

The Live-stock Division :—

If made from good, sweet hay, as you suggest, "hay tea" would have some nutritive value, but would not be sufficient alone to bring up calves on. We would advise some small addition of meal or pollard, or alternating the diet with skim-milk similarly enriched. The first-stated mixture could be used for comparatively young calves, provided the change-over was not too abrupt.

ARTICHOKES FOR PIG-FEEDING.

"ARTICHOKE" Milton :—

Will you please give me information as to what is the best method of cultivation and planting of artichokes for pig-feeding? Would artichokes fatten pigs, or would the pigs be required to be topped off by peas, grain, or some such feed?

The Fields Division :—

Artichokes require good, rich ground in order to give heavy yields. This does not mean that they cannot be grown on medium types of light soil, but, as can be expected, where such ground is used heavy yields cannot be expected. In regard to varieties to plant, there is little to choose between the purple and the white kind. In preparing the ground the treatment should be the same as for potato-growing. The artichoke tubers are best planted in rows 36 in. apart and 30 in. apart in the rows. The crop can be put in during September, and as the plants are frost-resistant they will not suffer from any late frosts which might occur. Any seed-merchant would supply the tubers, which, if large, may be cut into sets for planting, although fairly large uncut seed is really best. A good manure is 1½ cwt. superphosphate, ½ cwt. blood manure, and ½ cwt. kainit. Successive crops can be grown from one planting by harvesting with pigs if sufficient small tubers are allowed to remain as seed for the following year's crop. Once planted, artichokes require a great amount of cultivation to get rid of them in a field. In actual food value artichokes may be reckoned as slightly higher than potatoes. They may be regarded, however, as a supplementary feed to other crops grown on the farm—well suited for providing several weeks' food and shade during the hottest period of the year.

MULCHING AND MANURING OF STRAWBERRIES.

"STRAWBERRY," Henderson :—

I have been told that when pine-needles are used as a mulching for strawberry-plants the crop is seriously affected, and in some cases the plants ruined. Is there any truth in this statement? Would coarse trefoil hay make a suitable mulch? When is the correct time for mulching? I have manured a strawberry plot with ½ ton of blood-and-bone, 5 cwt. basic slag, and 5 cwt. sulphate of potash to the acre. Should that be sufficient? The soil has been cropped for the past twelve months and is fair-quality gum land.

The Horticulture Division :—

Injury to a strawberry crop from the use of pine-needle mulch is unusual, and that the plants have been ruined by it is doubtful. When a crop fails, great caution is needed to correctly locate the cause. Coarse hay is a decidedly dangerous material for a mulch for this purpose on account of the seeds it contains and the probability of fouling the land with weeds and twitch. For commerial purposes straw should be used, and even that is best exposed to the weather for a while before application, so that all seeds contained are sprouted first. The mulch is best applied as the flowering season commences. The manure mentioned by you should be sufficient under normal conditions. When the crop is in blossom a dressing of 2 cwt. nitrate of soda per acre might be given if the plants appear to be at all lacking in vigour.

CULTIVATION OF PHORMIUM TENAX.

W. N. MILLER, Havelock North :—

Would you kindly give me some information about growing flax (*Phormium tenax*) as follows: (1) Method of growing on suitable ploughable land—(*a*) if by plants, (*b*) if by seed; (2) general method of converting suitable land into flax-bearing country; (3) cost if done by (*a*), cost if done by (*b*); (4) approximate cost to market fibre; (5) blights, risk of failures, &c.; (6) approximate return of, say, 15 per cent. fibre crop; (7) approximate price of flax land in the various flax-growing areas.

The Fields Division :—

Following are seriatim answers to the queries: (1) and (2). Method of growing phormium on suitable ploughable land: (*a*.) If by plants, run out a furrow, place the fans 5 ft. apart, and tramp in the roots well; width between rows, 7 ft. It is considered that the best method is to place the fans all the one way in the rows. Prune the leaves when shifting. Care must be taken to leave the sucker. Cut the leaves well up the sucker so that it will have protection from wind and weather. When transplanting, it is necessary to have the land prepared to receive the plants, and plant as soon as possible after removal; if the roots are allowed to become dry the plant will get quite a check. (*b*.) If by seed, sow in rows, say, 1 ft. apart, and cover lightly. March, August, and September are probably the best months for sowing. (3.) Cost of planting per acre: (*a*) £12 to £15 per acre; (*b*) by waiting two years for seedlings, probably one-third less than under (*a*). After first cost of draining, fencing, and planting, there is very little expenditure necessary to promote the growth. (4.) Approximate cost to market fibre: This depends largely on the locality and royalties allowed for green leaf; the average may be put at £24 per ton. (5.) Blights, risk of failure, &c.: Blight-resisting varieties are not definitely known, but certain black-edge varieties appear to be resistant, and as a rule give a good percentage of fibre. (6.) Approximate return of, say, 15 per cent. fibre crop: About £10 per ton on dressed hemp. (7.) Approximate price of flax land: From £25 to £30 per acre.

FERTILIZERS FOR RASPBERRIES.

W. J. FAWCET, Tadmore :—

Would you kindly advise me if a mixture of 85 per cent. superphosphate and 15 per cent. sulphate of potash would be a suitable and complete manure to use on raspberries? The soil is a sandy loam with clay subsoil.

The Horticulture Division :—

The manure dressing for raspberries which you suggest—85 per cent. superphosphate and 15 per cent. sulphate of potash—should suit the crop very well. Considerable advantage would probably be derived by a later dressing also of nitrate of soda, about 2 cwt. to the acre.

DRYING OFF COWS.

"ANXIOUS," Granity :—

Would you kindly advise me if it is necessary to dry a cow off six weeks before she calves? I have a cow which has been milking since October, 1924, and at the time of writing is averaging 12 lb. of milk a day, and is due to calve next month. The feed she is getting now is a mash of bran, chaff, and pollard twice a day, a few linseed-nuts at milking-time, and a little hay, mangolds, with a picking of grass. She is in the very best of condition.

The Live-stock Division :—

As a rule it is advisable to dry cows off some six weeks before calving, and we should recommend you to do this with the one you mention. Seeing that your cow appears to be in good condition and is milking so well close up to calving, the best method is to cut down her feed, not in quantity but in quality. Discontinue to give the linseed-nuts and pollard; chaff and hay will be quite sufficient. A dose of Epsom salts, ¾ lb. to 1 lb., according to the cow's weight and condition, given in 2 quarts of warm water, will assist in drying her off.

WEATHER RECORDS: AUGUST, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during the month of August was generally dull and wet, though on the whole fairly mild in the North, but very bleak at times, especially in the South. Rainfall appears to have been below the average in the Auckland Province and on the west coast of both Islands, but greatly in excess on the east coast, especially of the South Island.

A storm of somewhat local character occurred in Canterbury on the 6th and 7th, with heavy rain, snow, and bleak weather. A cyclone passed in the North between the 12th and 15th, accounting for high east to south-east winds and some heavy downpours. Anticyclonic (fine weather) conditions followed, and the highest reading of the barometer, 30·675 in., was registered at Wellington on the morning of the 17th. An intense westerly disturbance passed in the South, with a barometer-reading of 28·95 in. at the Bluff, on the 23rd, and was preceded and followed by very unsettled weather. Snow, hail, and thunderstorms were reported at various times on high country of the South, and some sleet at lower levels.

The wet weather was a great hindrance to arable farming operations in Canterbury, and growth of grass was delayed by several frosts and dull weather in many parts of the country.

—*D. C. Bates, Director.*

RAINFALL FOR AUGUST, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
	North Island.			
	Inches.		Inches.	Inches.
Kaitaia	9·17	23	3·74	5·10
Russell	4·96	23	1·50	6·99
Whangarei	6·35	20	1·60	6·93
Auckland	3·68	17	1·09	4·21
Hamilton	3·04	20	0·66	4·15
Kawhia	3·48	18	0·42	4·60
New Plymouth	5·06	18	0·82	5·38
Riversdale, Inglewood	6·94	20	1·21	8·65
Whangamomona	4·69	15	1·15	5·80
Tairua, Thames	5·37	14	1·99	6·98
Tauranga	3·20	15	1·03	4·17
Maraehako Station, Opotiki	8·80	17	3·42	4·75
Gisborne	8·74	21	2·23	4·50
Taupo	2·68	12	1·02	4·23
Napier	4·10	20	0·80	2·96
Maraekakaho Station, Hastings	4·08	22	1·35	3·31
Taihape	3·32	20	0·84	2·67
Masterton	5·51	21	0·86	3·26
Patea	3·61	16	0·66	3·57
Wanganui	2·03	8	0·35	2·78
Foxton	3·02	9	0·62	3·04
Wellington	8·17	21	1·49	4·40
	South Island.			
Westport	5·41	12	1·02	6·27
Greymouth	5·64	11	1·19	7·87
Hokitika	9·80	12	2·13	9·45
Arthur's Pass	18·36	10	4·78	13·13
Okuru, Westland	20·58	9	4·38	11·46

RAINFALL FOR AUGUST, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Collingwood	8·43	18	2·23	6·96
Nelson	3·27	11	0·89	3·05
Spring Creek, Blenheim	3·88	12	1·50	2·86
Tophouse	4·60	12	1·33	4·87
Hanmer Springs	7·08	17	1·16	2·23
Highfield, Waiau	5·45	11	1·35	2·28
Gore Bay	4·58	12	1·70	2·28
Christchurch	5·97	19	0·88	1·75
Timaru	2·20	15	0·48	1·48
Lambrook Station, Fairlie	2·13	10	0·60	1·53
Benmore Station, Omarama	2·09	14	0·44	1·50
Oamaru	2·41	13	0·70	1·76
Queenstown	5·69	11	2·25	1·80
Clyde	2·28	9	1·30	0·80
Dunedin	5·91	13	1·80	3·15
Gore	2·78	17	0·72	2·26
Invercargill	3·24	17	0·70	3·36

INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 16th July to 10th September, 1925, include the following of agricultural interest:—

No. 51621: Milking-machine teat-cup; H. E. Kjestrup, Rangitumau. No. 52202: Milking-machine valve; J. H. Mason, Feilding. No. 53843: Milk-can cleaning and drying apparatus; J. O'Connell and H. H. Kerr, Kensington, Vic. No. 54071: Wire-strainer; R. F. Walker, Opunake. No. 52131: Milking-machine; A. Hislop, Stirling. No. 54047: Powdered-milk manufacture; N. H. Christensen, Windsor, Vic. No. 54130: Cow-leg rope; F. T. F. Evans and L. H. Burgoyne, Auckland. No. 52398: Cultivator; J. E. Holland, Christchurch. No. 53069: Lime, &c., spreader and distributor; G. Pain, Melbourne. No. 53799: Hay-sweep; Cooper and Curd, Pukekohe. No. 54191: Stack-cover; R. T. Hill, Taupiri. No. 52169: Swingletree; A. R. E. Amor, Christchurch. No. 52623: Cheese-treatment; Popper Cutter Company, New York. No. 52725: Milk-can ventilator; C. E. R. Allen, Patetere. No. 52763: Milk cooling or heating means; R. A. Forsman, Gordonton. No. 53017: Milk-stirring and sample-removing appliance; D. M. Wallace, Te Aroha. No. 53307: Fencing-dropper; W. E. Macalister, Kauana. No. 53916: Woolpack; R. F. Smaill, Dunrobin. No. 54053: Milking-machine pipe-line aerating; I. R. Webster, Rotorua. No. 53068: Seed and fertilizer drill; G. Pain, Melbourne. No. 53152: Plough-lifting mechanism; W. F. Murray, Clydevale. No. 54182: Cheese-hoop; W. L. Luxford, Auckland.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price, 1s.

REVISED PRICES FOR CARBON BISULPHIDE.

The Department has found it possible to reduce the price of the 5-gallon drums of carbon bisulphide, sold for rabbit-destruction, from 40s. to 37s. 6d. per drum, freight paid to nearest railway-station. In the North Island, for the convenience of smaller settlers, the Department has placed on the market a limited number of 2-gallon drums of carbon bisulphide, and these are being retailed for 17s. each.

CONTROL OF GRAIN-WEEVIL: A FARMER'S EXPERIENCE.

MR. E. H. BEAMISH, Kohatunui, Whanawhana, Hastings, forwarded the following notes under date 3rd August, 1925:—

I have read with interest in the *Journal* for July the advice given for the control of grain-weevils. My own experience may also be of use to those who are unlucky enough to have this trouble. Owing to the unduly wet season in the autumn of 1924 I was unable to sow the barley I had secured, and I stored it in the stable-loft during the winter. In the same loft I had shot out about 2 tons of oaten chaff. I first noticed the presence of weevils in the barley early in November, and by the end of the month they must have been present in millions. They seemed to attack the Russian in preference to the Cape barley, and they were also all through the chaff.

Acting on the advice of my local merchants, I fumigated the loft with sulphur by burning it in tins set up on bricks about the floor. It was very soon apparent where the fumes were escaping, so prior to the next fumigation I stopped up all these openings with paper, and had the loft practically sealed. I repeated this five times in all, using about 10 lb. of sulphur for each fumigation. Prior to the fumigation the sacks of barley were literally black with weevils, and by putting one's ear close to the sack the noise closely resembled that of a swarm of bees. After each fumigation I swept up and removed weevils by the bucketful, apparently mostly dead; but to ensure this I threw in some kerosene and fired the whole mass.

I had noticed that the kerosene seemed to kill the weevils instantly, so I decided to spray the whole building. Naturally, it was impossible to spray while the grain and chaff were still in the loft, so I disposed of the barley for fowl-feed, and in due course fed all the chaff. It is interesting to note that the presence of the weevils in the chaff did not affect the horses eating it, notwithstanding that they could get an abundance of grass. The Cape barley was very little damaged, but the Russian barley was absolutely ruined, as evidenced by the weight of the sacks, which had been reduced by three-quarters.

Having the whole building clear, I sprayed it throughout with a strong kerosene emulsion, and, to make sure, I also sprayed the cow-bails and cart-shed (which are at either end of the stable building), the stalls, feed-boxes, chaff-box, and in fact every nook and corner.

Naturally, after the removal of the grain the numbers of weevils decreased very considerably, but the spray, which I put on with a force-pump, brought them out from all sorts of cracks and crevices. In every instance where they came in contact with the emulsion it killed them—if not at once, then in a very few hours. I carried out this spraying on two consecutive days, and then again in a week's time.

It is now two months since I last sprayed the building, during which time I have never had more than ten bags of chaff in the loft. During this period I have noticed odd weevils in the corners of the mangers and in the chaff-box. I carefully inspected the loft to-day, and, while I found many weevils dead—the loft having been thoroughly swept about a month ago—there were also odd ones alive on the walls. I am informed that the cold weather kills them, so during the only frosty weather we have had here this winter I opened the doors and windows of the loft last week, and this may account for the dead weevils seen to-day. It is my intention to spray again when the next frosty snap sets in, in the hope that it will clear up all the stragglers.

In conclusion, I would summarize my experience as follows:—

(1.) The weevil apparently breeds more freely in barley than in oats.

(2.) Fumigation with sulphur kills a big proportion of those present.

(3.) Kerosene emulsion, sprayed on with a force-pump and applied at intervals, will eventually destroy weevils.

(4.) Weevils can exist in a building, either as the mature insect or in the egg stage, for at least nine months, and with apparently no immediate access to food in the way of grain for at least part of that period.

CLOSING OF MOUMAHAKI STATE FARM.

THE annual report of the Director-General of Agriculture for 1924–25 refers to this matter as follows :—

"The Moumahaki Farm has been subdivided for the purpose of placing settlers upon it, and the Department's own farming operations there will shortly come to an end. It was decided that the income derived from the settlement of the farm should be utilized for the purposes of agricultural instruction in the area lying, roughly speaking, between Wanganui and New Plymouth, and legislation in this connection was enacted during last session. The Moumahaki Farm during its earlier operations by the Department served an exceedingly useful purpose. In view, however, of the great improvement in general farming conditions in that portion of New Zealand its usefulness has largely disappeared, and there can be no doubt that the new order of things will have the effect of conferring a greater benefit upon the Wanganui - New Plymouth district than could have been the case had the farm continued to be operated by the Department.

The whole trend of present-day experience indicates that a greater benefit can be conferred upon settlers by an expansion of instructional services, combined with small demonstration or experimental areas, than by the continued operation, or the expansion, of the State-farm system. The practical demonstration farms established at Stratford and Manaia by local effort, and subsidized by the Department, are doing excellent work, and it seems evident that it is with farms of this type in suitable areas, rather than large State farms, that the best work for the future can be done."

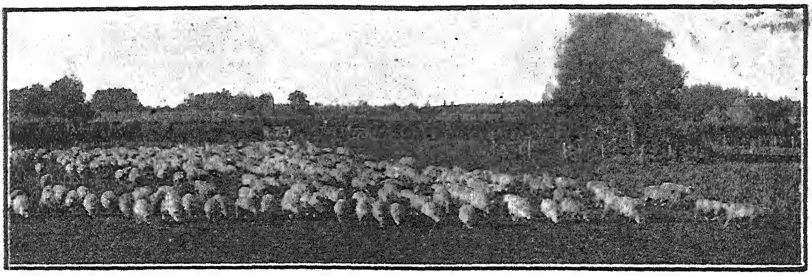
EGGS AND EGG-PULP IN COLD STORAGE.

A RETURN issued by the Government Statistician shows the following stocks as at 31st July, 1925, corresponding figures for the same date in 1924 being added in parentheses: Eggs in shell, 4,243 dozen (956 dozen); egg-pulp, 584,601 lb. (325,706 lb.); frozen whites, 1,773 lb. (2,836 lb.); frozen yolks, nil (nil).

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Hastings, 21st and 22nd October, 1925.
Poverty Bay A. and P. Association: Gisborne, 27th and 28th October.
Wairarapa A. and P. Society: Carterton, 28th and 29th October.
Marlborough A. and P. Association: Blenheim, 28th and 29th October.
Timaru A. and P. Association: Timaru, 28th and 29th October.
Manawatu A. and P. Association: Palmerston North, 3rd, 4th, and 5th November.
Ashburton A. and P. Association: Ashburton, 5th November.
Canterbury A. and P. Association: Royal Show, Christchurch, 11th, 12th, and 13th November.
Wanganui Agricultural Association: Wanganui, 11th and 12th November.
Egmont A. and P. Association: Hawera, 18th and 19th November.
Otago A. and P. Association: Dunedin, 18th and 19th November.
Stratford A. and P. Association: Stratford, 25th and 26th November.
North Otago A. and P. Association: Oamaru, 26th and 27th November.
Wyndham A. and P. Society: Wyndham, 4th December.
Auckland A. and P. Association: Auckland, 4th and 5th December.
Horowhenua A. and P. Association: Levin, 26th and 27th January, 1926.
Rodney Agricultural Society: Warkworth, 6th February.
Dannevirke A. and P. Association: Dannevirke, 10th and 11th February.
Pahiatua A. and P. Association: Pahiatua, 13th February.
Masterton A. and P. Association: Solway, 16th and 17th February.
King-country Central A. and P. Association: Te Kuiti, 19th February.
Northern Wairoa A. and P. Association: Mititai, 20th February.
Franklin A. and P. Association: Pukekohe, 26th and 27th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 3rd and 4th March.
Temuka and Geraldine A. and P. Association: Winchester, 25th March.

Agricultural and Pastoral Association Secretaries are invited to supply dates and location of their shows for publication in the "Journal."



The New Zealand

Journal of Agriculture.

Vol. XXXI.—No. 4.

WELLINGTON, 20th OCTOBER, 1925.

DAIRY-HERD TESTING IN NEW ZEALAND.

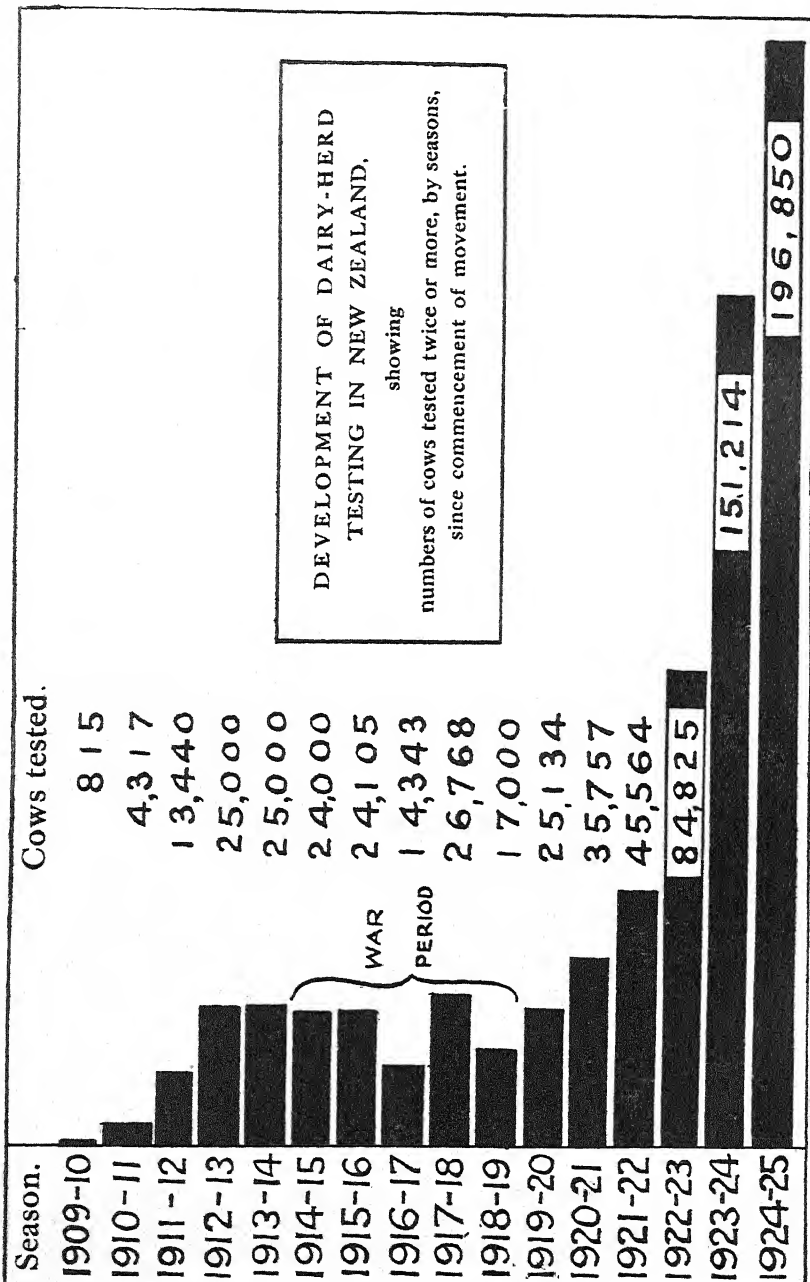
REVIEW OF 1924–25 SEASON.

W. M. Singleton, Director of the Dairy Division.

EXTENT AND SYSTEMS OF TESTING.

Dairy-herd testing in the Dominion has again shown a substantial increase in the number of cows under test. The figures for 1924–25, on the basis of all cows tested twice or more, give a total of 196,850, as against 151,214 for the preceding season. This increase of 45,636 cows slightly exceeds the total number tested four years ago, during the 1921–22 season. In order to enable readers to see at a glance the progress made since the inauguration of the first testing association at Dalefield in 1909 the accompanying graph has been prepared (see next page). The group of years bracketed covers the period of the Great War, and for obvious reasons should be neglected when considering the progress of the movement. Of late years the popularity of the "Group" system has acted as a stimulus to herd-testing, and has helped in the breaking of much new ground. Dairymen now appear to be fully aware of the necessity of herd-testing, and so long as the movement extends as it has done in recent years we have every reason to feel confident that great improvement will eventually be effected in the average yield of our dairy stock.

Herd-testing in New Zealand is conducted under practically three distinct systems—namely, "Association," "Group," and "Dairy Company." In the Association system the members do their own


DEVELOPMENT OF DAIRY-HERD TESTING IN NEW ZEALAND,
showing
numbers of cows tested twice or more, by seasons, since commencement of movement.
Season.
Cows tested.
1909-10 815
1910-11 4,317
1911-12 13,440
1912-13 25,000
1913-14 25,000
1914-15 24,000
1915-16 24,105
1916-17 14,343
1917-18 26,768
1918-19 17,000
1919-20 25,134
1920-21 35,757
1921-22 45,564
1922-23 84,825
1923-24 151,214
1924-25 196,850
WAR PERIOD

weighing and sampling for as many of their cows as they please for two out of every thirty days. The samples are sent to a depot to be tested by the testing officer. In the Group system a testing officer visits the farms once a month, weighs and samples milk for each cow for twenty-four hours, and tests the samples. For the Association system figuring may be done by the secretary of the association or his staff, the testing officer, the secretary of the dairy company or his staff, the factory-manager, or, in the case of what are known as "Government" associations, by officers of the Dairy Division field or headquarters staff. Figuring of returns for the Group system is usually done either by the secretary of the association, his staff, or the testing officer. Testing under the Dairy Company method follows the Association system, except that the testing is always done by the factory-manager, and figuring is left to the farmers themselves. No association is formed, and generally no charge is made for the testing. Government associations are conducted entirely under the Association system, and quite often have no formed association. The members give authority to the dairy company to deduct from their payments the amount of fees due to the Dairy Division, and thus are held together to this extent.

These points having been made clear, the number of cows tested twice or more for the past three seasons, grouped according to the three systems outlined, may be presented in the following table:—

Table 1.—Numbers of Cows tested Twice or more, grouped according to Season and System of Testing.

System.	1922–23.			1923–24.			1924–25.		
	Number of Associations, &c.	Number of Cows.	Average Cows per Association, &c.	Number of Associations, &c.	Number of Cows.	Average Cows per Association, &c.	Number of Associations, &c.	Number of Cows.	Average Cows per Association, &c.
Association ..	90	67,835	754	114	96,198	844	117	87,695	750
Group ..	6	7,500	1,250	34	43,144	1,269	91	100,055	1,100
Dairy Company	46	9,490	206	42	11,872	283	51	9,100	178
All ..	142	84,825	597	190	151,214	796	259	196,850	760

Group testing has shown great increases, and it must be borne in mind that the season 1922–23 was the first year of its inception. The Association system proper has shown a small decrease for the past season, due to some of the groups absorbing some of the association members in thickly settled districts; while the Dairy Company system has remained fairly constant for the three years. The average number of cows per association under all types shows a peak in 1923–24, and it is thought that the slight falling-off for last season is partly due to associations opening up in more outlying and scattered districts than formerly.

Table 2.—Number of Cows tested Twice or more, grouped according to Year and Land Districts, &c.

Land District.	1922–23.			1923–24.			1924–25.		
	Total Cows in Milk.	Cows tested Twice or more.	Percentage.	Total Cows in Milk.	Cows tested Twice or more.	Percentage.	Total Cows in Milk.	Cows tested Twice or more.	Percentage.
North Auckland	164,993	17,973	10·9	174,965	23,521	13·4	180,039	31,049	17·7
Auckland ..	266,054	32,123	12·1	288,903	63,945	22·1	300,149	93,912	32·5
Gisborne ..	23,821	2,419	10·2	26,328	3,122	11·9	26,955	4,022	14·9
Hawke's Bay ..	43,720	1,629	3·7	46,880	4,391	9·4	48,689	5,468	11·2
Taranaki ..	187,818	15,585	8·3	192,220	18,567	9·7	193,414	16,840	8·7
Wellington ..	175,483	12,534	7·1	184,450	30,584	16·6	185,597	37,415	20·2
North Island ..	861,889	82,263	9·5	913,746	144,130	15·8	934,843	188,706	20·7
South Island ..	262,782	2,562	1·0	271,231	7,084	2·6	260,724	8,144	3·1
Dominion ..	1,124,671	84,825	7·5	1,184,977	151,214	12·8	1,195,567	196,850	16·5

In order to follow the trend of increase in herd-testing for the various districts during the past three seasons Table 2 has been compiled. The percentages indicated are on the basis of all cows in milk only, and not for all cows in milk and dry. The number of cows in milk are given as at 31st January of each year, and are those compiled by the Government Statistician. If a cow is indicated as dry at this period of the year it is doubtful if she would be included in the number of cows tested. It will be noticed from the table that for the whole of New Zealand the percentage of cows tested has risen steadily, despite the continual increase in the total cows in milk, till it now stands at 16·5 per cent. This means that, roughly, one cow out of every six available for testing was tested during the past season. This is very creditable when it is considered that the total number of cows in milk has risen 6·3 per cent. from 1922–23. The North Island tested one cow out of every five, and has shown good increases every year. The South Island, although it has shown steady increase, tested only 3·1 per cent. of its total available cows, and leaves room for much extension in the movement. We understand, however, that in one district at least of the South Island this position will be rectified during the present season.

AVERAGE YIELD OF TESTED COWS.

Much useful information may be gleaned by summarizing all association results, and the necessity for these to be made available for this purpose must be stressed. The Dairy Division during the last three years has made every effort to collect annual summaries of production from all testing associations operating in the Dominion.

In 1922–23 annual summaries received represented 76 per cent. of the total number of cows tested other than under the Dairy Company system; in 1923–24 this percentage rose to 92 per cent.; and for 1924–25 it stands at 91 per cent. We take this opportunity of thanking all those who supplied annual summaries of results.

From annual summaries received for the 1924–25 season 151,875 cows altogether are represented in the averages, as against 107,777 for 1923–24 and 50,753 for 1922–23. Table 3 gives the numbers of cows, herds, and associations represented in the summaries received for the past two seasons. The other figures give the average size of herds and associations. Table 4 gives similar information according to the system of testing adopted.

Table 3.—Cows, Herds, and Associations represented in Season's Summaries received.

—	1923–24.	1924–25.
Number of associations	140	190
Number of herds	3,837	4,815
Number of cows	107,777	151,875
Average number of herds per association	27	25
Average number of cows per herd	28	32
Average number of cows per association	770	799

Table 4.—Average Size of Associations for which Season's Summaries were received, according to System adopted, and on Basis of all Cows in Milk 100 Days or more.

System.	Season.	Herds per Association.	Cows per Association.	Cows per Herd.
Association	1923–24	28	641	23
Association	1924–25	25	574	23
Group	1923–24	25	1,203	48
Group	1924–25	26	1,185	45

Table 5 supplies the grand summary of all association-testing results available for the past two seasons. Figures are given on the basis of all cows in milk 100 days or more. The average production shown in a similar table for 1922–23 was 233·71 lb. fat in 225 days. The past season's figures show about 10·5 lb. butterfat increase over 1923–24, but are about 10 lb. below 1922–23.

Table 5.—Grand Summary of all Association-testing Results available for Last Two Seasons.

—	1923–24.		1924–25.	
	Days in Milk.	Pounds Butterfat.	Days in Milk.	Pounds Butterfat.
Average of all cows (107,777 in 1923–24 and 151,875 in 1924–25)	230	213·010	229	223·54
Highest association average	255	302·86	259	319·78
Lowest association average	175	140·16	169	154·13
Highest herd average..	301	585·76	308	442·25
Lowest herd average	120	57·25	130	38·78
Highest cow	300	780·12	365	870·07
Lowest cow	109	18·23	223	28·61
Average daily production of butterfat for all cows	..	0·93	..	0·98

The effect of nature of season experienced must be given due consideration, and true comparison of one season's results with another's will remain difficult unless some coefficient can be arrived at from which it will be possible to standardize all annual results to the common basis of an average season. It is unreasonable also to expect much increase in the average yield of all association-tested cows so long as the number of cows under test is increasing so much each year and naturally includes more and more unproved animals. It is generally the more progressive dairymen who first take up systematic testing, and men who as a rule have better producing cows than others in their district. When eventually the less progressive dairymen join up with associations the advance in average production which would otherwise have been shown is lost in counterbalancing the effect of the poorer herds of these new members. It is therefore very encouraging to see that average association production has been so well maintained for the past three seasons.

Another point which needs consideration is the difference in conditions between the two main systems of testing—Association and Group. As mentioned previously, many very poor cows are not continued for as much as a hundred days under the Association system, whereas under the Group system the member has little option.

Then again, groups continue for a longer average number of days for much the same reason. To exemplify this latter statement it may be stated that all associations under the Association system last year averaged 221 days in milk, while for all Group associations the average was 235 days. Now, on an average, cows are producing about ½ lb. of butterfat per day at this stage, so that the Association average should be raised by about 7 lb. of butterfat to put it on a Group basis. The average Association yields have been estimated on a Group basis for all records available for the past three years, and are as follows: 1922–23, 237 days, 239·32 lb. fat; 1923–24, 237 days, 216·54 lb. fat; and 1924–25, 235 days, 226·72 lb. fat. The Division has made a practice of running out annual summaries for those associations which are tested by their officers on the basis of all cows in milk 210 days or more. Summaries on this basis give a better idea of the average production for dairy cows, for the reason that it eliminates those records where cows may have died, fallen sick, or have been sold or discontinued by members for reasons of their own early in the testing season. The difference between the summaries on the basis of 100 and 210 days is clearly shown in the following table:—

Table 6.—Average Production for Associations conducted by Officers of the Dairy Division, comparing Difference in Production between Results of Summaries compiled on the Basis of all Cows in Milk 100 Days or more and 210 Days or more.

Year.	100 Days.		210 Days.	
	Average Days.	Average Butter-fat.	Average Days.	Average Butter-fat.
1922–23	227	232·99	261	271·48
1923–24	227	221·39	258	267·10
1924–25	223	231·51	258	266·29

Now we may raise the estimated average production figures for all cows on the Group method to estimate average production on the Group basis for 210 days. The results are as follows: 1922–23, 272 days, 278·86 lb. fat; 1923–24, 269 days, 261·25 lb. fat; and 1924–25, 272 days, 260·78 lb. fat. These figures should act as a fairly reliable guide to the average production for all cows tested and for which long enough records are available. At the same time it is considered that the final results (were they available) would show a few pounds increase on these again. It has been our experience that only a small proportion of members give the drying-off dates for all cows, or even test long enough. Besides, late calvers, or cows continuing for longer periods than the average, are not given full credit, for the reason that all associations close down for the winter. In some districts members who supply milk to dairies for town consumption have cows running through from

Table 7.—Average Production, according to Land Districts, for all Association-tested Cows in Milk 100 Days and over for which Season's Summaries were obtained.

Land District.	1922–23.				1923–24.				1924–25.			
	Average Days.	Average Fat.	Cows in Summary.	Percentage of Total Cows in Milk.	Average Days.	Average Fat.	Cows in Summary.	Percentage of Total Cows in Milk.	Average Days.	Average Fat.	Cows in Summary.	Percentage of Total Cows in Milk.
North Auckland ..	215	214·63	11,117	6·7	219	200·23	16,270	9·3	216	205·14	25,685	14·3
Auckland	219	226·75	15,184	5·7	234	207·86	48,253	16·7	235	224·98	77,003	25·7
Gisborne	222	220·08	1,852	7·8	209	202·16	2,026	7·7	204	208·34	3,455	12·8
Hawke's Bay	234	251·62	1,072	2·5	231	228·34	1,790	3·8	243	233·25	4,575	9·4
Taranaki	238	263·27	12,565	6·7	233	246·66	13,377	7·0	233	251·58	11,683	6·0
Wellington	236	229·98	7,817	4·5	237	215·60	22,402	12·1	228	230·99	24,199	13·0
North Island	226	234·08	49,607	5·8	232	213·56	104,118	11·4	230	224·48	146,600	15·7
South Island	208	217·76	1,146	0·4	194	197·47	3,659	1·3	197	197·36	5,275	2·0
Dominion	225	233·71	50,753	4·5	230	213·01	107,777	9·1	229	223·54	151,875	12·7

one season to another, and cause overlap in the association testing season, and for the above-mentioned reason miss a few important periods of testing. For these reasons the association average may be taken as being on the conservative side.

In order to compare the average association production in the various districts over the past three years Table 7 is presented. The most striking point is that the six land districts of the North Island, despite considerable variation in the seasons experienced, have maintained the same order for height of production.

INCIDENCE OF CULLING.

Table 8 gives the Government Statistician's figures for the totals of dairy cows in milk, cows dry, and cows in milk and dry for the various land districts for the past three years as at 31st January of each year. Table 9 gives the percentages for these figures on the basis of the preceding year. From the tables it will be seen that, with the exception of the South Island, considerable increase has taken place for all districts in the numbers of cows in milk and cows in milk and dry. In regard to the numbers of dry cows, it will be noticed that Auckland and Taranaki show decreases. Cows dry at the period of the year to which these figures apply may be expected to be comprised of cows normally dry (winter calvers) and cows dry because of disease—in particular, contagious mammitis and abortion—also " dud " animals. One would expect the ratio between the numbers of cows in milk and cows dry to keep much the same year by year, provided neither class included undesirables of this sort. It appears, therefore, that Taranaki and Auckland are weeding out from the dry class at least. Table 10 gives the totals and percentages of the slaughterings at meat-works and abattoirs year by year for bullocks and heifers, cows, and total cattle. The figures were supplied by the Live-stock Division.

Slaughterings have varied year by year for all classes, and much of this variation is due to fluctuations in the price of beef. A minimum was reached in 1921–22, this being mainly due to the slump in prices immediately preceding and obtaining at that time. It will be noticed, however, that slaughterings of cows have increased since this period to a considerable extent, until for 1924–25 they are, roughly, 7 per cent. higher than for any of the previous years. When the slump came many fat-stock raisers turned to dairying for a few years until better prices ruled. Many of the cows used for this purpose were undoubtedly of beef type, as shown in Table 11.

This turnover of beef cows to the dairy class and then back again caused much of the fluctuation shown, and the effect on the percentage of dry to all dairy cows is obvious.* Reverting to Table 10, it is now evident what happened to many of the cows not killed during the slump period. During that period the killings of bullocks and heifers did not fall off as much as those of cows. However, any accumulation which did occur was dispensed with in 1923–24, for the number of bullocks

* Some of this diversion of beef cows to dairy purposes was due, of course, to the high prices obtaining for butterfat during the years 1918, 1919 1920, and 1921. It must be borne in mind, howeve, that a severe slump in the price of butterfat occurred in 1922, and it was about this time, although both beef-raising and the dairy industry were at a slump, that dairying appeared to be the better proposition of the two.

Table 8.—Number of Dairy Cows in New Zealand (including Boroughs).

Land District.	31st January, 1923.			31st January, 1924.			31st January, 1925.		
	Cows in Milk.	Cows Dry.	All Cows.	Cows in Milk.	Cows Dry.	All Cows.	Cows in Milk.	Cows Dry.	All Cows.
North Auckland	164,993	20,883	185,876	174,965	22,359	197,324	180,039	24,318	204,357
Auckland	266,054	26,466	292,520	288,903	25,174	314,077	300,149	24,092	324,241
Gisborne	23,821	3,427	27,248	26,328	4,633	30,961	26,955	4,737	31,692
Hawke's Bay	43,720	6,641	50,361	46,880	7,353	54,233	48,689	7,985	56,674
Taranaki	187,818	13,940	201,758	192,220	11,340	203,560	193,414	10,612	204,026
Wellington	175,483	18,332	193,815	184,450	20,195	204,645	185,597	19,809	205,406
North Island	861,889	89,689	951,578	913,740	91,054	1,004,800	934,843	91,553	1,026,396
South Island	262,782	34,283	297,065	271,231	36,558	307,789	260,724	36,312	297,036
Dominion	1,124,671	123,972	1,248,643	1,184,977	127,612	1,312,589	1,195,567	127,865	1,323,432

Table 9.—Increases or Decreases for Cows in Milk, Cows Dry, and all Cows (Supplementary to Table 8).

Land District.	1924 Figures expressed as Percentages of 1923 Figures.			1925 Figures expressed as Percentages of 1924 Figures.		
	Cows in Milk.	Cows Dry.	All Cows.	Cows in Milk.	Cows Dry.	All Cows.
North Auckland	106·0	107·1	106·2	102·9	108·8	103·6
Auckland	108·6	95·1	107·4	103·9	95·7	103·2
Gisborne	110·5	135·2	113·6	102·4	102·2	103.2
Hawke's Bay	107·2	110·7	107·7	103·9	108·6	104·5
Taranaki	102·3	81·3	100·9	100·6	93·6	100·2
Wellington	105·1	110·2	105·6	100·6	98·1	100·4
North Island	106·0	101·5	105·6	102·3	100·5	102·1
South Island	103·2	106·6	103·6	96·1	99·3	96·5
Dominion	105·4	102·9	105·1	100·9	100·2	100·8

and heifers killed in 1924–25 shows a considerable decrease. More cows are now being killed, and it seems hardly likely that this is solely due to a hold-over, for in that case such cows would in all probability have been disposed of at much the same time as held-over bullocks and heifers. It therefore appears that a considerable number of these extra cows must be cull dairy cows.

Table 10.—Numbers and Percentages of Cattle slaughtered at Meat-works and Abattoirs.

Year ended 31st March.	Bullocks and Heifers.	Percentage of Total.	Cows.	Percentage of Total.	Total Cattle.
1917	176,102	53·6	139,315	42·4	328,708
1918	163,021	56·2	115,473	39·8	290,150
1919	184,696	60·0	109,501	35·6	307,816
1920	217,595	60·6	125,632	35·0	359,173
1921	195,751	64·1	99,759	32·7	305,363
1922	141,607	69·1	55,652	27·1	204,987
1923	189,737	67·4	76,514	27·2	281,364
1924	195,210	59·4	118,032	35·9	328,809
1925	179,528	45·2	197,328	49·6	397,43[illegible]

Table 11.—Increases in the Number of Dairy Cows compared with Increases or Decreases of Total Cattle other than Dairy Cattle.

("Total cattle other than dairy cattle" includes calves, but excludes stud bulls. Each year's figures are expressed as percentages of the preceding year, except in the case of dry dairy cows, which are expressed as percentages of the total dairy cows in milk and dry for the same years.)

Year (as at 31st January).	Dairy Cows in Milk and Dry.	Total Cattle other than Dairy.	Dry Dairy Cows.
1918	102·0	115·8	10·4
1919	104·1	106·3	11·3
1920	108·1	99·8	12·3
1921	112·4	96·4	11·3
1922	113·1	102·4	10·7
1923	109·8	102·1	9·9
1924	105·1	100·9	9·7
1925	100·8	96·7	9·6

CONCLUSION.

The foregoing review indicates that the present position of herd-testing is very satisfactory, and that the movement is now receiving the serious attention of most dairy-farmers. Not only are large increases being made in the number of cows tested year by year, but the average yield is also being well maintained. As long as increased numbers of new cows are being tested each year no advance in the average yield of all tested cows may show itself, but this is no reason why it should be assumed that no improvement is being effected in that respect.

The writer desires to acknowledge the co-operation of Mr. W. N. Paton, of the Dairy Division headquarters staff, in the preparation of this article.

NOTES ON SOME MANURIAL EXPERIMENTS IN CANTERBURY AND OTAGO.

(Concluded.)

F. W. Hilgendorf, D.Sc., Canterbury Agricultural College, Lincoln, and
C. L. Gillies, B.Ag., Boys' High School, Timaru.

The trials here summarized are a continuation of those published in the *Journal* for January, 1925. The source of information is the same, and the calculations have been made by the same methods. The writers are indebted for assistance to Mr. W. C. Purdie, of Marlborough College, Blenheim, who calculated the averages and errors of the wheat trials, and many students of Lincoln College have contributed to the results by working out parts of the tables during their study of the methods of making and interpreting agricultural experiments.

SWEDE MANURIAL TRIALS.

These were conducted by the Department of Agriculture on four farms in Canterbury and twenty-seven in Otago during the years 1911–16. In every case considered six plots were tried on the same farm, every series containing one unmanured plot, one with 1½ cwt. super, and so on. The results are given in tons per acre of roots alone, and the computation of odds in favour of significance of the results is calculated by the method known as "Student's." Each plot is differenced against the 1½ cwt. super plot on the same farm and year, since that manuring may be considered standard practice. Mixture No. 5 (potash), however, is contrasted with manure on Plot 4 for a reason obvious on examination. Owing to the weighings of one of the pairs being absent in numerous cases it is not always the same twenty or thirty plots that are used as the standard. For instance, Plots 1 to 25 may be used in one case, and Plots 5 to 30 in another, but the comparison is always between plots on the same farm and in the same year.

Table 1.—Swede Manurial Trials.

Series No.	Manure.	Number of Trials.	Yield in Tons per Acre.	Yield of Corresponding Plots of 1½ cwt. Super.	Gain or Loss in Tons.	Odds in Favour of Significance.
1	No manure ..	28	15·5	27·9	−12·4	Thousands to 1.
2	2 cwt. guano ..	17	25·6	23·8	+ 1·8	20 to 1.
3	3 cwt. super ..	28	27·0	25·8	+ 1·2	6 to 1.
4	2 cwt. super + ½ cwt. or ¾ cwt. bonedust	27	29·4	26·7	+ 2·7	Hundreds to 1.
5	No. 4 + ¼ cwt. sulphate of potash	18	29·1	29·4 (Yield of No. 4)	− 0·3	Odds against.

There is no doubt a loss through using no manure. Each of the other manures gives some gain over 1½ cwt. super, though the gains due to 2 cwt. guano or 3 cwt. super are not sufficiently certain to allow these manures to be recommended without further trial. The case of 2 cwt. super plus ½ cwt. or ¾ cwt. bonedust, however, is on a very different footing, for this mixture gives a gain of 2·7 tons over 1½ cwt. super, and the high figure assigned to the probability of the significance of the result indicates that the advantage was obvious in the great majority of the trials.

Taken as a whole, the results of the various manures on the swedes have been of the same nature as on the turnips, but the heavier dressings and the slower-acting manures have naturally been more effective.

Table 2.—Comparison of Results of the Same Manures on Turnips (see Journal, *January, 1925) and Swedes.*

Series No.	Manure.	Gain or Loss on 1½ cwt. Super.	
		Turnips.	Swedes.
1	No manure	9·0 tons loss ..	12·4 tons loss.
2	2 cwt. guano	1·2 tons loss ..	1·8 tons gain.
3	3 cwt. super	0·6 tons gain ..	1·2 tons gain.
4	2 cwt. super + ¾ cwt. bonedust	1·0 tons gain ..	2·7 tons gain.
5	No. 4 + ½ cwt. sulphate of potash	0·1 tons loss on No. 4	0·3 tons loss on No. 4.

No manure causes a greater loss in the swedes than in the turnips, because the crop as a whole is a heavier one. 3 cwt. super gives a better result in the swedes, because swedes are usually grown in districts with damper climatic conditions than turnips, and so the greater quantity of manure is brought into solution. Guano, and bone-dust added to super, give a better result with swedes, because the crop is longer in the ground than turnips, and so the slow-acting manures have time to become available. The two series of trials thus support each other, and give a very clear indication that for Otago conditions the best manure so far experimented with is something of the nature of 2 cwt. per acre of super plus ½ cwt. or ¾ cwt. of a slow-acting phosphate such as guano or bonedust. The high probability of the significance of the result in the case of swedes makes this conclusion specially worthy of note.

It is each farmer's business to determine whether, under the circumstances in which he is placed, the expenditure on an additional ½ cwt. super and ½ cwt. or ¾ cwt. of bonedust or guano is justified by a return of about 1 ton of turnips or about 2½ tons of swedes.

It is important to note that in neither set of experiments did potash give the slightest result.

POTATO MANURIAL TRIALS.

These were conducted on thirty-three farms in Canterbury and Otago during the years 1911–16. Each manured plot was compared with an unmanured plot adjacent to it.

Table 3.—Potato Manurial Trials.

Series No.	Manure.	Number of Trials.	Yield in Tons per Acre.	
1	No manure	18	8.0	
2	$2\frac{1}{2}$ cwt. super	19	9·5	See text below.
3	2 cwt. super + $1\frac{1}{2}$ cwt. bonedust	18	9·2	
4	2 cwt. super + $\frac{1}{2}$ cwt. bonedust	18	10·1	
5	2 cwt. super + $1\frac{1}{2}$ cwt. bonedust + $1\frac{1}{2}$ cwt. blood ..	18	9·9	
6	$2\frac{1}{4}$ cwt. super + $\frac{7}{12}$ cwt. bonedust + $\frac{7}{12}$ cwt. blood ..	19	10·4	
7	2 cwt. super + $1\frac{1}{2}$ cwt. bonedust + $\frac{3}{4}$ cwt. sulphate of ammonia + 1 cwt. potash	18	9·8	
8	2 cwt. super + $1\frac{1}{2}$ cwt. bonedust + $1\frac{1}{2}$ cwt. blood + 1 cwt. sulphate of potash	18	9·6	
9	2 cwt. super + $\frac{1}{2}$ cwt. bonedust + $1\frac{1}{2}$ cwt. blood + $\frac{1}{2}$ cwt. sulphate of potash	18	9·8	

All the manured plots show an increase over the unmanured ones, but the unavoidable errors in the experiment are such as to make of no significance the differences between the figures bracketed together. The average increase due to manure is $1\frac{3}{4}$ tons per acre, and there is therefore no doubt that manuring pays. The figures, however, give no indication which manure gives the highest yield.

A series of plots, not included in the table, manured with 4 cwt. super yielded only 8·5 tons per acre. The range in the results was, however, so great as to leave it inconclusive whether this represents a real diminution on the $2\frac{1}{2}$-cwt.-super yield, or one due only to error in experiment. The figure is suggestive, not conclusive.

Comparing plots with and without potash, it is evident that no significant increase has been obtained by the use of this manure.

After a critical examination of the figures on which the table is based it is found that the following conclusions may safely be drawn: (1.) There is a certainty of increase in yield by manuring. (2.) There is no indication which manure gives the best result. The non-significance of the differences between various manures is emphasized by a comparison of the results from Series 3 and 4, or from Series 5 and 6. (3.) Since there is no indication from the experiments that the more expensive manures give higher yields, the cheapest manure—namely, super—is the best to use, unless local experience, or until more elaborate experiments, prove otherwise.

MANGOLD MANURIAL TRIALS.

These trials were conducted on about equal numbers of farms in Canterbury and Otago—in all nineteen—during the seasons 1911–16. The same method of treating the results was followed as in the trials previously dealt with, and always a manured plot was compared with an unmanured one adjacent to it. In addition the effect of adding in turn each fertilizing constituent—for example, potash, salt, guano, and blood—was determined.

Table 4.—Mangold Manurial Trials.

Series No.	Manure.	Number of Trials.	Yield in Tons per Acre.	
1	Unmanured ..	19	31·0	
2	2 cwt. super ..	19	40·4	See text below.
3	No. 2 + 1 cwt. guano..	19	41·8	
4	No. 3 + 1 cwt. sulphate of potash	19	42·4	
5	No. 4 + 1 cwt. salt ..	19	41·9	
6	No. 5 + 1 cwt. blood ..	19	40·3	
7	40 cwt. lime ..	17	35·7	

There is here an increase of yield due to manuring, but the unavoidable errors in the experiment are such as to make of no significance the differences between the figures bracketed together.

For the Taranaki, Wanganui, and Feilding districts, Deem (this *Journal*, Oct., 1923, p. 225) finds that a liberal dressing of phosphatic manures produces the best crops. This conclusion is supported by the figures in the foregoing table. The average increase is about 10 tons per acre by manuring with any of the mixtures given. It appears that super would be the least expensive manure to use to secure this increase, and there is little doubt that this manuring is a payable one.

In view of the common practice of applying salt and potash in special mangold-manures, it is interesting to note that there is no significant increase in yield when these constituents are added.

Plots manured with 40 cwt. lime alone gave a significant increase of about 5 tons per acre.

The result of a critical examination of the figures allows the following conclusions to be drawn with safety: (1.) There is a certainty of increase in yield by manuring. (2.) There is no indication from the experiments which manure gives the best results. (3.) In the meantime super is the most economical manure to use.

WHEAT MANURIAL TRIALS.

As mentioned in the introduction, we are indebted to W. C. Purdie for working out the results of these trials. They were conducted on nineteen farms in Canterbury and Otago, and all comparisons are from trials on the same farm and in the same year.

Table 5.—Wheat Manurial Trials.

Series No.	Manure.	Number of Trials.	Yield in Bushels per Acre.	
1	No manure ..	15	35·6	See text.
2	Super, ½ cwt. ; gypsum, 1 cwt...	12	34·3	
3	Super, 1½ cwt.	12	41·6	
4	Super, 1 cwt. ; bonedust, ½ cwt.	14	37·7	
5	Super, 1 cwt. ; gypsum, ½ cwt...	15	40·9	
6	Super, 1 cwt. ; gypsum, ½ cwt. ; potash, ½ cwt. ..	14	36·7	

Fourteen other manurial mixtures were tried on wheat, but none of them was used on more than five plots, and so their figures have not been considered.

No definite conclusion can be drawn from the figures presented. The considerable increase shown in the superphosphate series is at first sight very attractive, but about half the increase is due to one trial, where super gave 41 bushels per acre more than the adjacent unmanured plot. Such a record reduces the reliability of the result, and this is expressed in the high probable error, which, in the complete tables, will be found attached to the increase here shown. Similar abnormal variations give a high probable error to the result shown for Series No. 5, so that one is not able to say with certainty that the manuring has given an increased yield. On the contrary, the odds in favour of a real increase from the use of 1½ cwt. super prove to be 16 to 1—sufficient to indicate that this manure is well worth a further trial. If Series 2 and 3 are compared it is found that the increased yield from 1½ cwt. super over ½ cwt. super is a real one (odds 40 to 1 in favour of significance), and this is another indication of promise from further trials of super on wheat.

Most readers will be aware that such further trials have already been made by Mr. M. J. Scott, of Lincoln College, and by Messrs. Ward and Hudson, of the Department of Agriculture (see this *Journal* for April last). The modern methods used have secured very much more rapid and conclusive results than were possible with the older style of experiments here analysed, and it is now certain that manuring with 1 cwt. of super will increase the yield of wheat by about 7 bushels per acre on certain land near Christchurch. The recent experiments, similarly to the older ones, give no indication of economic utility in the more expensive manures.

The chief value of the whole series of trials here summarized—those on turnips, mangolds, &c., as well as those on wheat—is to indicate what experiments are likely to give rapid and conclusive results in the hands of present day workers.

OAT MANURIAL TRIALS.

Nineteen different manurial mixtures were used on oats, but, unfortunately, most of them were used in only a few cases. Inspection of the figures shows that the majority of the trials could yield no definite information, and so only those that were tried most frequently have had their results worked out. The trials recorded were made on eleven farms (six in Canterbury and five in Otago) during the season 1911–12.

Table 6.—Oat Manurial Trials.

Series No.	Manure.	Number of Trials.	Yield in Bushels per Acre.	
1	No manure	11	62·8	
2	Super, 1 cwt.	11	70·0	See text.
3	Super, 1 cwt. + nitrate of soda, ½ cwt. + gypsum, ½ cwt.	11	70·4	
4	Super, 1 cwt. + sulphate of potash, ½ cwt. + gypsum, ½ cwt.	11	71·8	

There is a significant increase, beyond the limits of experimental error, in the case of each manure tried, but the differences between the various manures are due merely to the conditions of the experiment. It can safely be said that the increase in each case is due to the super rather than to the nitrate or potash.

The marked result from manures on oats, compared with that obtained from wheat, is probably due to the better place in the rotation given to wheat. Where both cereals are grown, wheat comes after grass or after rape, when noticeable quantities of available plant-foods are present in the soil. Oats, on the other hand, usually come after wheat, when the accumulated store of reserve foods has been used up, and therefore the crop responds well to the available food artificially supplied.

CONCLUSION.

This completes the summarizing of the South Island co-operative manurial trials for the years 1911–16. Their chief value is (1) to indicate promising lines for future investigation, and (2) to demonstrate the overwhelming importance of phosphatic manures on every kind of farm crop, and the absence of apparent effect of potash and such nitrogenous fertilizers as were tried on all the crops dealt with.

Tables and calculations will be published separately.

A NEW JERSEY CHAMPION—HOLLY OAK'S ANNIE.

THE performance under certificate-of-record test of the Jersey cow Holly Oak's Annie, completed on 28th September, marks a new record for the breed in New Zealand, surpassing the yield of the previous champion, Vivandiere, by some 20 lb. of butterfat. Holly Oak's Annie was bred by Mr. John Hale, of New Plymouth, and was first purchased by Messrs. H. H. Sutton and Co., of Longbush, Masterton, who tested her during the 1921–22 season, when, as a junior two-year-old, she gained a C.O.R. for 586·06 lb. butterfat. The outstanding record just completed, however, was made on the farm of her present owner, Mr. W. T. Williams, Pukehou, Hawke's Bay. Commencing at the age of five years and nine days, Holly Oak's Annie yielded in 365 days 18,522·7 lb. milk containing 1,056·49 lb. butterfat—a New Zealand Jersey record for both milk and butterfat. Holly Oak's Annie has yet to complete her requirements for C.O.R. by calving subsequent to test. It is expected that she will calve about 20th November, which will be a month or so within the period for a first-class certificate permitted by the C.O.R. rules. Congratulations are extended to Mr. John Hale, breeder of the new champion, and to Mr. W. T. Williams, who enabled her to use to such advantage the productive ability which she so evidently possesses.

—*W. M. Singleton, Director of the Dairy Division.*

FAT-LAMB RAISING.

AN OUTLINE OF NEW ZEALAND METHODS

Live-stock Division.

THE breeds of sheep used in the production of fat lambs for the New Zealand meat-export trade vary in accordance with the physical conditions and different qualities of soil in the various districts. The lamb most favoured for the trade is the product of the half-bred Merino high-country station ewe crossed with a Southdown, Shropshire Down, or Hampshire Down ram (the Southdown being most largely used), or the progency of a Southdown ram from Romney, Leicester, or Romney-Lincoln crosses. Early-maturing lambs may be obtained from these crosses.

In New Zealand sheep-breeding the foremost considerations given to foundation flocks are constitution and wool, together with conformation and a symmetrical carcase. The main flocks are grazed on the higher grasslands. The ewe lambs from them are selected each year for the points just mentioned, and graded later into the ewe flock. The standard of the flocks is maintained by this selection of the best within themselves.

The surplus lambs are either sold as fats (many off their mothers), or as stores for fattening on rape, turnips, kale, or other supplementary forage specially grown for the purpose, mostly on the lower, richer lands. The ewes culled from the foundation flocks are sold to and utilized by the smaller graziers and fat-lamb farmers of the more closely settled areas to produce a crop of lambs. The only point considered here is suitability for the meat-export trade, and it is in this phase of farming for lamb-production that consideration is given to the cross with the short-woolled breeds of sheep (usually Downs) for the production of a medium-sized, compact, uniform, and symmetrical carcase.

In mating, the usual number of rams used is about 2 to 2½ per cent. —that is, one to fifty or one to forty ewes. The use of one to fifty is the more common on level, unbroken lands, and proves effective and efficient, especially if the ewes are rounded up or placed in small paddocks occasionally for a night, and provision made for a few rams to be kept fresh and used in the final tupping-week. The rams are kept on good feed and in good service condition, but not allowed to become gross before the period of service.

The time of putting out the rams is governed by climatic, altitudinal, and latitudinal conditions, and varies from the latter part of February to the middle of April. The rams are kept with the ewes for about six weeks, and then drafted out. This ensures a lamb harvest completed within a definite period. It is not a general practice to flush the ewes during the mating-period. In most seasons in the New Zealand climate the growth of autumn feed provides sufficient incentive, though there are sometimes years when flushing is beneficial.

After docking, the lambs are run with the mothers on good grass-pastures or on supplementary crops, and care is taken that they

receive no check, in order that as many prime milk-fat lambs as possible shall be available for freezing. In years when feed is abundant the proportion of milk lambs is large; in ordinary seasons 50 per cent. would be the outside limit. The remainder, after weaning, are placed on breaks of forage crops to be fattened. Milk lambs are usually ready for the market in from twelve to fourteen weeks. Those weaned and fattened on pasture or forages go to the freezing-works in from twenty to forty weeks. Prime-quality first-grade lamb ranges from 36 lb. to 40 lb. dressed-carcase weight. Carcases over 42 lb. are paid for as second quality.

For lamb-fattening on forage crops land of comparatively high value—say, up to £50 per acre—is often used. For breeding alone a value capitalized on a rental of 7s. for every wet ewe the land is capable of carrying per acre is a fair basis of calculation for a valuation of the land as a business proposition. Carrying-capacity on pasture alone may be put at from one-half to three sheep per acre, but aided by cultivation and supplementary forages six, seven, or even eight sheep can often be carried.

It will be seen that there are three main variations of farming conducted in connection with the fat-lamb business:—

(1.) The breeding of lambs in the foundation flocks, the surplus remaining after the better ewe lambs have been drafted for the maintenance of the flock being sold as freezers, or as stores to growers of supplementary forages for fattening.

(2.) Sheep-raising on the richer and more improved lands by farmers who breed their own ewe flocks (reserving a selection of ewe lambs each year) and grow sufficient fodder to fatten the lamb crop, and also the ewes culled annually.

(3.) The annual purchase by graziers and croppers of supplementary forages of breeding-ewes from culled station lines, from which a crop of lambs is produced and turned off as freezers. The ewes are also fattened and sold off either annually or every second year. This method of quitting both the ewe and the lamb necessitates the purchase each year in the open market of surplus station cull ewes. When the high-country lambing percentages are below the average, and as a consequence the quittings from the stations are limited, such procedure may make the prices paid for ewes in the autumn abnormally high. This explains the lack of uniformity in values of breeding-ewes over any period of years.

There are also general farmers who grow areas of forages, turnips, &c., and either sell the crops to others for fattening purposes, or themselves purchase store lambs and fatten them in autumn.

Levy on Export Fruit.—An Order in Council under the Fruit Control Act, gazetted on 1st October, prescribes that the levy on export fruit produced in districts in which Part I of the Act is in operation shall be 1d. per half-bushel case and 2d. per bushel case. This replaces the previous scale of ½d. and 1d. respectively.

WAIMAUNGA EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1924-25.

C. S. DALGLIESH, Fields Instructor, Hokitika.

THE principal features in the development of Waimaunga Experimental Farm (Grey Valley) during last season were the provision of farm-buildings and a residence, and the introduction of a dairy herd—grade Jerseys and Guernseys from Moumahaki Experimental Farm, to be headed by a Jersey bull. The farm-steading consists of a cow-byre, open-fronted hay and implement sheds, and a three-stall stable, all under one roof and covering 1 chain square. The separator and engine rooms are detached from the main building.

PASTURES.

For particulars of pastures established in Fields 1, 2, 3, and 4 interested readers are referred to the writer's article in the *Journal* for September, 1924. A study of these pastures strongly emphasizes the fact that management must take precedence over mere expenditure.

Field 1, which had less expensive and also less preparatory treatment than the others, is more than holding its own in the production of feed and in lasting quality. This field was sown in November, 1921, and was top-dressed in May, 1924, as follows: (1) Basic slag, 3 cwt. per acre; (2) superphosphate and Nauru phosphate (equal parts), 3 cwt.; (3) carbonate of lime, 1 ton; (4) carbonate of lime, ½ ton, followed by 1½ cwt. superphosphate in the spring. Little or no difference has been noticeable in any of the dressings as compared with the control plot, but the pasture has carried stock well.

Field 2 (sown in temporary pasture in September, 1922) received much more preparatory cultivation and a more liberal liming, but it has largely reverted back to sweet vernal. This may be attributed to the smothering effect of the clover in the early part of the first year, its prolific growth smothering out the Italian rye-grass to a great extent. In this same field on a 2-acre area sown with a similar seeding a year later, but which has been continually fed down with stock, there has been a much better pasture and no reversion to sweet vernal.

The strip of land through Field 2 which did not receive an application of lime has proved an interesting feature. In the first year after sowing, the pasture on this area consisted of a thin distribution of sorrel, catsear, and inferior grasses. During the early part of last summer sweet vernal predominated; later on brown-top came very prominently into possession; and at present the strip very distinctly represents a pasture of poor carrying-capacity, and is very much left alone by stock.

The area of Fields 1 and 2 is 34 acres, and during from September to February last they carried and fattened 180 two-tooth ewes and wethers, the wethers killing at an average dressed weight of 63½ lb.

FIG. 1. PASTURE IN FIELD 2, WAIMAUNGA EXPERIMENTAL FARM.

Showing unlimed strip across centre of field, with brown-top dominant and neglected by stock.

FIG. 2. SOME OF THE TWO-TOOTH WETHERS FATTENED IN FIELDS 1 AND 2.

In addition, Field 1 carried forty milking-cows and six head of young stock during the last three weeks of December. January and the first two weeks of February were exceedingly dry, and pastures were consequently very bare, but after being spelled they quickly recovered.

Field 7 was sown in December, 1923, in a permanent-pasture mixture of—perennial rye-grass, 15 lb.; cocksfoot, 12 lb.; crested dogstail, 3 lb.; meadow-fescue, 4 lb.; red clover, 2 lb.; alsike, 2 lb.; white clover, 2 lb.; Lotus major, 1 lb., per acre. The land was manured with 2 cwt. superphosphate per acre, and limed in weights of 5 cwt., 10 cwt., 15 cwt., and 1 ton per acre. The heavier dressings of lime have undoubtedly given the best results. The 5 cwt. and 10 cwt. dressings have also given satisfactory results, though probably there is a little more weed-growth in the 5 cwt. area. The fact of this field having been utilized as a run-off for sheep which were feeding on

turnips in the winters of 1922 and 1923 played an important part in the good results obtained with the lesser weights of lime. Lighter applications of lime, together with the incorporation of humus in some form or other, produce a better and more lasting pasture than can be obtained with lime and artificial fertilizers alone.

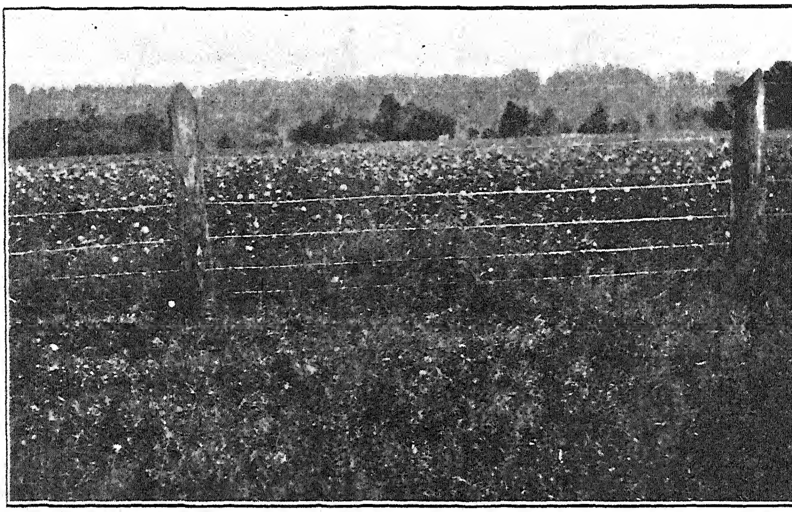


FIG. 3. SHOWING PASTURE IN FIELD 7 (BEYOND FENCE) WITH ABUNDANCE OF CLOVER. LIME TREATMENT, 5 CWT. PER ACRE.

The grass in the foreground of photo is mainly sweet vernal and brown-top.

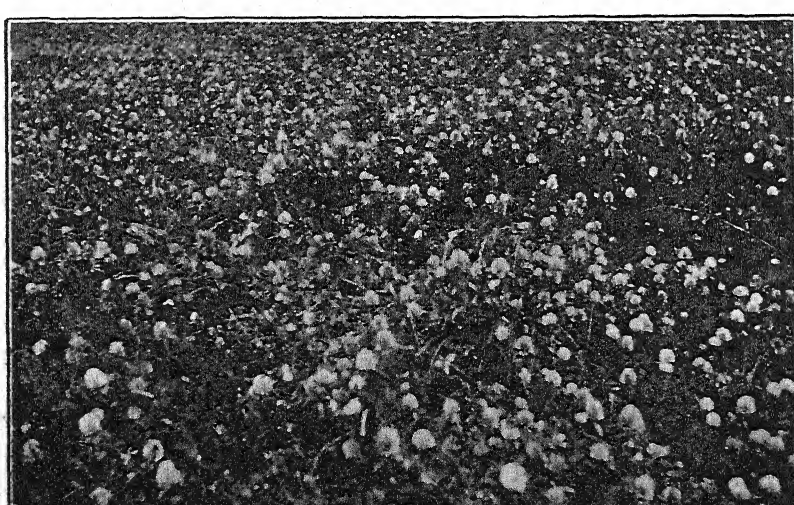


FIG. 4. NEAR VIEW OF PASTURE IN FIELD 7. LIME TREATMENT, 10 CWT. PER ACRE.

Field 7 was utilized for haying purposes last season, owing to the farm being understocked, and this has been detrimental to the permanent pasture. The prolific growth of clover when allowed to get away, as for haymaking, certainly has a depressing effect on the grasses. The practice of haying permanent pasture is admittedly bad; temporary pastures, such as Italian rye-grass and red clover, should be used for this purpose. Owing to the farm being understocked, a good deal more meadow hay was made than was required for the season.

SPECIAL HAY CROPS.

Areas of 4 acres of oats and peas and 4 acres of oats and vetches were grown on land which the previous year had grown oats for chaff and had then received 5 cwt. lime and 2 cwt. super per acre. The ground for the special hay crops was ploughed in early August, and had preparatory cultivation during September. Half the area received a dressing of carbonate of lime at 10 cwt., and the other half 5 cwt. ground burnt lime, per acre. The crops were sown across the field so as to test each form of lime.

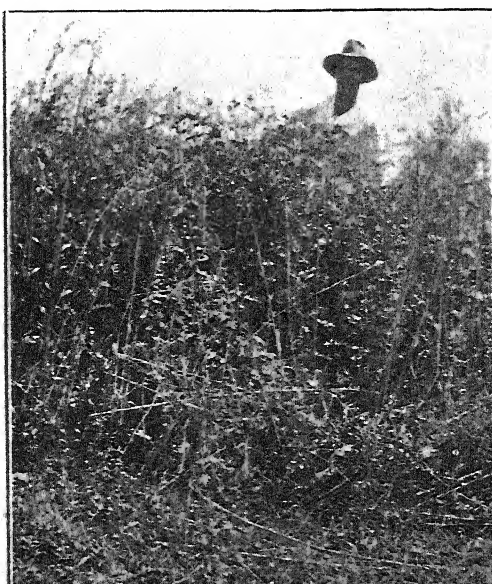


FIG. 5. CROP OF OATS AND VETCHES FOR HAY.

The peas and vetches were sown on 1st October, and the oats immediately after. The seedings per acre were: Garton oats, 1½ bushels, and Partridge field-peas, 2 bushels; Garton oats, 1½ bushels, and vetches, 1½ bushels. Both mixtures gave heavy crops, showing better growth than the previous oat crop. The oats and peas were the more equal and easily handled and cured crop of the two; the hay-yield was 2 tons 11 cwt. per acre, harvested on 30th January.

The oats and vetches were a heavier crop than the oats and peas; much of the crop was down at time of harvest, making the work difficult. The vetches predominated, and retarded the growth of oats from the commencement. The sowing of less vetches than $1\frac{1}{2}$ bushels per acre may be recommended; $\frac{3}{4}$ bushel to 1 bushel should be ample to sow with $1\frac{1}{2}$ bushels of oats. This crop produced 2 tons 17 cwt. of hay per acre. The hay was fed to dairy stock during the winter and readily eaten.

OATS FOR CHAFF.

This crop consisted of 5 acres Algerians, 3 acres Garton's, and one each of the Crown, Victory, Black Tartar, and Great Mogul varieties. All varieties were sown on 7th October. The land—old pasture—was ploughed in the winter, and was manured at time of seeding the oats with 2 cwt. per acre of super and Nauru phosphate in equal parts. All varieties were light, but the Garton's produced the greatest weight per acre. The Algerians—the earliest for harvest—were cut on 2nd February, and the other varieties a week later.

ROOT CROPS.

Carrots and Mangolds.—These consisted of $1\frac{1}{2}$ acres of Matchless White carrots and $1\frac{1}{4}$ acres of Prizewinner Yellow Globe and Long Red mangolds, both crops being grown on land having received similar cultivation and liming treatment. One ton of lime per acre was applied; a strip 1 chain in width across the field was left without lime, and 1 chain width received 1 ton carbonate of lime per acre. Both crops were sown in raised drills during the last week in October.

The carrots were quite a good crop, averaging on the limed land 31 tons per acre, and on the carbonate-of-lime strip 28 tons. On the area which received no lime the roots were small and not worth weighing. The manure used was $1\frac{1}{2}$ cwt. super and $1\frac{1}{2}$ cwt. bonedust per acre.

The mangolds gave good promise at first, but later failed to thrive. The Prizewinner variety, however, did better than the Long Red. The manurial treatment was varied as follows: (1) Equal parts of super and Nauru phosphate, at 5 cwt. per acre; (2) super (two-thirds) and blood-and-bone (one-third), at 3 cwt., 5 cwt., and 8 cwt. per acre. The whole crop was poor and not considered worth weighing, as no definite results could have been obtained.

Swedes.—An area of $2\frac{1}{2}$ acres of swedes was grown on land which had produced a very heavy crop of oats and vetches in the preceding season. The land for swedes was ploughed in the first week of August. No endeavour was made to cultivate to keep weeds in check; they were allowed to make fair growth, and then ploughed under in the third week of October The land was again ploughed at the latter end of November. It was thus allowed to stand in the furrow the maximum length of time. In this district, where there is a high and consistent rainfall, by cultivating to keep down weeds the land is made fine, becomes air-locked, and the soil cannot get aerated. The swedes were sown in raised drills on 12th and 13th December; variety, Superlative; seeding, 12 oz. per acre. One ton

of lime per acre was applied during the first cultivation after the latest ploughing.

The area was treated experimentally with manures, the control manure being 1 cwt. each of super and bonedust per acre, and other manures being added. As this experiment was carried out for the sole purpose of determining the action of manures on the quality of the roots, the subject will be dealt with in a later article. The whole crop made excellent growth, and the major portion was thinned within the first month. Little trouble was experienced with weeds. During the investigation a number of weighings were made, and the crop averaged 36 tons per acre.

Turnips.—Two acres of the following varieties of turnips were sown in the same field as the swedes: Hardy Green Globe, Imperial Green Globe, Green-top Yellow Aberdeen, and Purple-top Aberdeen. These were not sown in raised drills, but on the flat. The manure used was 1 cwt. super and 1 cwt. Nauru phosphate per acre; 6 cwt. of lime was also applied. The larger portion of the land received cultivation similar to that of the swede land. Three small areas were reserved for late ploughing experiments; they were not ploughed in early August together with the other part of the field, but were turned over about the third week in November and given good cultivation. All varieties made excellent growth during the first few months, and gave promise of a heavy crop, but this did not continue, and the crop all round was a light one. The land which received the three ploughings and little cultivation was markedly free of weed-growth.

CHOU MOELLIER.

A small area of this fodder plant was grown, with good results. Liming, 1 ton lime per acre; manure, 3 cwt. per acre of mixed super and bonedust; seeding, 1 lb. per acre, in drills 26 in. apart. The seed germinated very quickly, and the plants made quick growth and were thinned to about 18 in. apart. Owing to being without dairy stock on the farm in the autumn this fodder was not utilized as it should have been. It was fed to yearling cattle during the winter, and was eaten in preference to turnips.

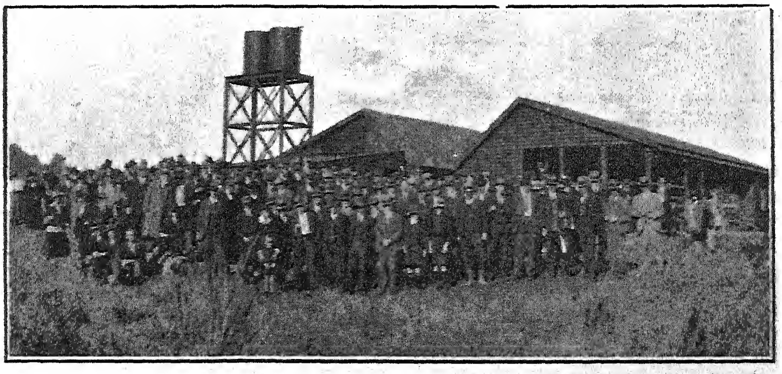


FIG. 6. FARMERS' FIELD-DAY GATHERING AT WAIMAUNGA.

[Photo by C. S. Dalgliesh.

GENERAL.

In addition to the dairy herd (thirty-two cows and heifers, and eight yearlings) now on the farm, there are 102 two-tooth Romney-cross ewes, which will be bred from this season. Two Border Leicester rams have been purchased from Lincoln College for this purpose.

In December last pupils from the Greymouth High School and Cobden primary school paid a visit to the farm. On 15th July a very successful field day was held in connection with the Westland winter farm school.

SUBTERRANEAN CLOVER IN PASPALUM PASTURES.

C. J. HAMBLYN, B.Ag., Assistant Instructor in Agriculture, Auckland.

THE value of subterranean clover in paspalum pastures is well recognized by farmers in the Auckland Province. This is evidenced by the large number of farms on which efforts to introduce this clover have been made. In many cases failure has resulted, and careful inquiries have been made as to the relative success of the various methods adopted.

As far as the better-class volcanic soils are concerned, no difficulty is experienced, for on them subterranean clover naturally establishes itself. On such soils where the pasture otherwise consists dominantly of rye-grass, cocksfoot, and white clover the presence of subterranean clover in large amounts is not altogether desirable, as it has a tendency to leave large bare patches in midsummer, and these frequently become invaded with weeds. Where paspalum is dominant on such soils, subterranean is the most valuable of all clovers, not only yielding well when the production from paspalum is at its lowest point, but also stimulating the summer development of that grass and at the same time lessening any danger of a root-bound condition arising.

Paspalum, however, is, or should be, frequently the dominant grass on soils of much lower fertility than those of volcanic or alluvial origin. On these it often becomes completely dominant, to the almost complete exclusion of all other grasses and clovers. Paspalum, being a gross feeder, soon lowers the surface fertility of poor soils, with the result that, although quite permanent, its seasonal yield falls away, and a root-bound condition, giving very little feed, results. It is on soils of this description and where the paspalum pasture is root-bound that the farmer particularly desires to establish subterranean clover, and it is just under these conditions that failure has most frequently occurred.

The introduction of subterranean clover can be viewed from two distinct points—its introduction during the actual establishment of paspalum pasture, or after the paspalum has become more or less sod- or root-bound. In the former case subterranean clover, at the rate of 1 lb. per acre, is frequently sown in the autumn on cultivated

land with a pasture mixture containing paspalum. The subterranean clover generally germinates well, but has a decidedly bad effect on the paspalum by tending to smother out the young plants. It is therefore better to establish the paspalum without subterranean clover, and rely on other methods for its later introduction.

A popular method in the past has been to surface-sow old sod-bound paspalum areas with 2 oz. to 1 lb. of subterranean clover, with or without other grass-seeds and manure. The paspalum is either fed off closely or burnt before this sowing, which latter is done either in the autumn or early spring. This method is the simplest and most generally adopted, but has so far given little success. The subterranean-clover seed, being large, is easily found by birds, which also do much damage by attacking the young plants as they appear above ground. Comparatively few plants survive, as the birds seem to prefer subterranean to either white or red clover. Again, the fertility having fallen well below that required for white clover (and especially is this so on root-bound areas), it is also too low to maintain subterranean clover in thriving condition. Therefore, unless top-dressing is maintained, the clover soon goes out.

Another method is the sowing of 1 lb. to 2 lb. of subterranean-clover seed, with or without other grasses and clovers, on an area of paspalum renovated by ploughing. The area is ploughed in narrow furrows after the first autumn rains, left a few weeks for the paspalum to push through between the furrows, then disked and surface-sown with rye-grasses and red, white, and subterranean clover. If the ploughing cannot be done in the autumn it may be left till early spring (August or September), but it must be done while the soil is moist. This method has proved a success, especially where fertility is maintained by top-dressing. It is undoubtedly the best method to adopt, and should be carried out on a small area first. When once established the subterranean-clover seed can be easily spread on to other paddocks by stock, especially by feeding out hay saved from an established paspalum-subterranean clover pasture.

The seed of subterranean clover is costly, and large areas mean a considerable loss in the event of failure to establish. The following points should be remembered: (1.) Subterranean clover will not grow luxuriantly on the poorest soils; it demands a fertility standard almost as high as that for white clover. Therefore top-dressing is essential. (2.) Subterranean-clover seed is taken by birds when surface-sown. The seed should be covered. (3.) The young plants are readily eaten by birds, especially when a thin seeding is made. It is better to sow 1 lb. to 2 lb. on a small area specially prepared to establish the clover, and then, by feeding out hay and by means of stock-manure, carry it on to other paddocks. (4.) When sown with paspalum-seed it tends to smother the young paspalum-plants. The best plan is to establish the paspalum pasture first, and then introduce the subterranean clover as a part of the renovation, or by feeding out hay containing the seed.

Noxious Weeds Orders.—Toad-flax (*Linaria vulgaris*) has been added to the Third Schedule of the Noxious Weeds Act. The Thames County Council has declared foxglove to be a noxious weed within that county.

RABBIT-POISONING BY STRYCHNINED THISTLES.

Live-stock Division.

MUCH interest has been shown recently in a method of poisoning rabbits by means of strychnine applied to thistles, introduced in Central Otago by Mr. James Tait, of Kawarau Gorge. Over extensive areas of rough depleted country in this district wing thistles form a large part of the vegetation, and are fed on naturally by the rabbits. The danger of sheep or other stock being also poisoned is said to be avoided by the fact that the strychnine is applied to the root of the thistle below the ground surface.

The method has been investigated lately by officers of the Agriculture Department, and the following report by Mr. F. R. Bould, Inspector of Stock, Clyde (dated 4th August, 1925), is published for general information:—

On 27th July Mr. Tait demonstrated to me his method of laying the strychnine. The method is simple, a scrape being made at the root of the thistle, which is split in half, showing from 3 in. to 4 in. of white surface. Strychnine prepared in the form of a thin paste is applied to this part of the thistle with a brush.

On the following days a demonstration was carried out on Messrs. Holloway Bros.' run, on country that had been pollard-poisoned in the autumn, afterwards being trapped, and recently strychnine-poisoned with carrots on a furrow. The piece of country chosen was a rough stony face difficult to get on to with a horse, and a likely place in which to see rabbits among the rocks. Four hours were taken to treat the thistles, and the following morning 126 dead rabbits were picked up. The next day the ground was again gone over, and forty-two more rabbits were taken off.

One of the most surprising things noticed was the number of very old rabbits, and also the number of those without all their legs, having been trapped at some time or other. I am of the opinion that these are the rabbits that are seldom seen, and which are responsible for the infestation in the spring of country that appears after the winter to be in good order.

I also inspected Mr. Malcolm Ritchie's run, on which Mr. Tait carried out his initial experiments. Some of this was very rough rocky country—just the place for rabbits to thrive on—and had been well pollard-poisoned and trapped. When only 10 per cent. of the traps were getting rabbits in them, and the property had a good appearance so far as rabbits were concerned, Mr. Tait's method was tried without in any way spelling the ground. The result was 400 rabbits taken off 200 acres in a few days. Since then the warrens have all been blocked up, and, at the time I inspected, no sign of any being opened could be seen. The balance of the run of some 2,000 acres is in a similar condition, only three rabbits being seen during five hours spent in inspecting the property.

Questioned as to the danger to sheep, Mr. Tait stated that he had poisoned the whole of Mr. M. Ritchie's run among the sheep and did not kill one; further, he was prepared to do likewise on any other property. The method of laying did not give sheep much chance of eating any of the strychnine-treated thistles. Several other instances were given of good catches of rabbits on country appearing to be fairly clear of the pest.

In conclusion, I can say that the demonstration given was satisfactory from the point of view of getting the odd rabbits that inhabit the rocky ground—a difficult matter generally. The method is simple and easily carried out, and country where trapping is impossible and carrying carrots in for feeding before poisoning is laborious work can be done by it with a minimum of labour.

The period for which this method would have the best effects appears to be from early in June onwards, when the rabbits feed on the thistles as their natural food. It is a method also that would supersede trapping at this time of the year (August) on country where thistles can be found.

Mr. Tait is to be commended for the manner in which he is making this method generally known. After he found that it succeeded in getting rabbits where other methods failed, he informed all and sundry in the district around him.

The Department's District Superintendent for Otago has arranged for further trials to be carried out in different districts and on various classes of country, such as bare, tussocky-grass paddocks or river-beds, if thistles exist there On completion of these tests, if further information of value is brought out, another report will be made.

It may be added that the use of this method of rabbit-destruction is not confined to Central Otago; the Department has knowledge of its having been used elsewhere, although not to any great extent.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

TARANAKI-WANGANUI DISTRICT COMPETITIONS, 1924-25.

J. W. DEEM, Instructor in Agriculture, Wanganui.

COMPETITIONS on similar lines to those of previous years were carried out last season in the North and South Taranaki and Wanganui districts. The activities consisted of mangold and carrot growing in all three districts, calf-rearing in North and South Taranaki, and a poultry competition at New Plymouth. Sixty schools took part in the competitions, but in the case of some schools only one or two entries were made.

ROOT-GROWING.

The season, on the whole, was not a good one for this branch of the competitions. The weather was very changeable, and, added to this, the schools were closed for a long period owing to the epidemic of infantile paralysis. However, the judges were able to report that the closing of the schools had not done so much harm as was anticipated, and the standard of cultivation set up last year was well maintained.

The changeable weather and excess of moisture during the growing season were not very favourable for mangolds, and the average crop dropped from 56 tons 14 cwt. per acre in 1923-24 to 47 tons 11 cwt. On the other hand, the moist season suited carrots, and the average for this crop advanced from 28 tons 7½ cwt. to 35 tons 12 cwt. The heaviest crop of mangolds for the season was grown by Clarence Morrison, of Turakina. It weighed 101 tons 7 cwt. per acre, against Jean Miller's crop of 138 tons 13 cwt. in the preceding season. In carrots the best crop was grown by Roy Calvert, of Hillsborough, weighing 66 tons 13 cwt. per acre, against the 58 tons 10 cwt. crop grown by Freda McNeill, of Rawhitiroa, in 1923-24.

Material was supplied for 429 plots, and of this number 282, or 66·4 per cent., completed and were judged. In the preceding year the percentage of completions was 61·5. As has been the case in previous years, a large number of plots were destroyed by stock gaining access to them before judging-time. It is difficult to understand parents allowing this to happen year after year.

The placings for the championships were as follows :—

Mangolds.—North Taranaki: Eric Calvert, Hillsborough, 92 tons 1 cwt. per acre, 178 points, first; H. Graham, Waitara, 87 tons 2 cwt., 170 points, second; D. Muir, Waitara, 88 tons 17 cwt., 169¾ points, third.

South Taranaki: Phillip Wakelin, Toko, 98 tons 5 cwt., 191¾ points, first; Beatrice Oldfield, Okaiawa, 96 tons 5 cwt., 190¾ points, second; Edna Dakers, Kaupokonui 81 tons 5 cwt., 175¼ points, third.

Wanganui: Clarence Morrison, Turakina, 101 tons 7 cwt., 196¾ points, first; Dorothy Richardson, Maxwelltown, 78 tons 5 cwt., 171¾ points, second; Hugh Middleton, Waverley, 65 tons 5 cwt., 156¼ points, third.

Carrots.—North Taranaki: Monica Fabish, Tataraimaka, 55 tons 8 cwt., 148½ points, first; Roy Calvert, Hillsborough, 66 tons 13 cwt., 147¾ points, second; J. Keenan, Egmont Village, 51 tons 15 cwt., 144¼ points, third.

South Taranaki: Norman Hocken, Matapu, 66 tons 10 cwt., 153½ points, first; Willie Dakers, Kaupokonui, 56 tons 15 cwt., 148¾ points, second; R. Bobock, Ngaere, 56 tons 5 cwt., 143¼ points, third.

Wanganui: Bruce Duke, Kakaramea, 50 tons 12 cwt., 145 points, first; Geo. Boswell, Maxwelltown, 58 tons 13 cwt., 141½ points, second; Daphne Newman, Waitotara, 45 tons 6 cwt., 141½ points, third.

Very fine displays of roots were made at the New Plymouth, Hawera, and Wanganui winter shows. The competitive classes for roots grown by members of the clubs were also well patronized, the exhibits in some cases being better than anything shown in the open classes.

CALF-REARING

These competitions were confined to North and South Taranaki, there being sixty-five entries in the former and 122 in the latter. The calves were grade heifers, and were divided into classes representing the various breeds. Ninety-six calves judged in South Taranaki were made up of eighty-one Jerseys, ten Friesians, four Shorthorns, and one Ayrshire; while of fifty judged in North Taranaki thirty-six were Jerseys, seven Friesians, six Shorthorns, and one Ayrshire.

In addition to the judging for the best reared calf some districts provided prizes for the best dairy type. In 1923-24 the points for cost of feeding were reduced from 100 to 50, but in the season under review it was decided to cut these points right out so far as judging the calf is concerned. The information is still shown on the charts.

The championships for South Taranaki are as follows :—

Jerseys.—E. Putt, Huinga, first, with 180½ points; food used, new milk, whey, and hay tea; cost, 14s. 4½d. N. Wisnewski, Huinga, second, 176½ points; food used, new milk, whey, and Ceremilk; cost, 16s. 5½d. Lester Gernhoefer, Rawhitiroa, third, 173 points; food used, new milk, skim-milk, and Moose linseed-meal; cost, 14s. 9d.

Friesians and Shorthorns.—May Jones, Finnerty Road, first, 173 points; food used, new milk, whey, and linseed; cost, £1 3s. 8½d. Bessie Seed, Matapu, second, 170½ points; food used, new milk, whey, and Tui calf-meal; cost, 9s. 5d. M. Major, third, 167½ points; food used, new milk, skim-milk, and Moose linseed-meal; cost, £1 2s. 5d.

Taking the calves placed first, second, and third in four groups, the following averages are obtained: Jerseys—Cost of food per calf, 13s. 8d.; points gained by competitors, 172·2. Friesians and Shorthorns—Cost of food, 18s. 10d.; points, 154·3.

The highest cost set down for feeding a calf in South Taranaki is £2 18s. 5d., and the lowest 7s. 9d. In the former case the competitor gained 38 points for chart and 98 for condition, and in the latter 38 points for chart and 100 for condition. These results make plain the necessity of cutting out the points allowed for cost of feeding.

The standard of values for foods fixed by the committee is as follows:—

	s.	d.			s.	d.	
Fresh milk ..	6	0	per 100 lb.	Moose linseed-meal	20	0	per 100 lb.
Pan-skimmed milk	1	0	,,	Moose nuts ..	18	0	,,
Skim-milk (home)	0	8	,,	Crushed barley ..	11	6	,,
Skim-milk (factory)	0	6	,,	Linseed-meal ..	22	6	per cwt.
Whey	0	2	,,	Crushed linseed ..	26	0	,,
Palmer's calf-meal	21	0	,,	Linseed (whole) ..	20	0	,,
Oatmeal ..	21	0	,,	Crushed oats ..	12	6	per 100 lb.
Ceremilk ..	27	6	,,	Sharps (pollard)..	10	6	,,
Tui calf-meal ..	23	6	,,	Faterine ..	20	0	per gallon.
Meggitt's linseed-meal.. ..	15	0	,,	Hay tea ..	0	3	per 100 lb.

NOTE.—Washings of separators or cream-coolers absolutely barred.

JUDGING A CROP COMPETITION IN SOUTH TARANAKI.

Manufacture and Export of Casein.—The annual report of the Dairy Division for 1924–25 states that the grading of casein has been continued through the year at Wanganui and Auckland. There has been improvement in the quality, and the uniformity of consignments exported has reflected credit on the manufacturers. Efforts have been made to secure a cleaner skimming, so that the skim-milk from which the casein is made will contain a minimum of butterfat. By improved methods manufacturers are now able to make a rennet casein of good commercial quality, containing not more than 1 per cent. of fat, and this is finding a ready market. During the year ended 31st March, 1925, the quantities exported represent some 2,363 tons of lactic casein and 295½ tons of rennet casein, making a total of 2,658½ tons.

AGRICULTURAL EDUCATION IN NEW ZEALAND.

REPORT OF THE BOARD OF AGRICULTURE.

(Presented to Parliament by the Minister of Agriculture, September, 1925.)

PREFACE.

I. NOTES ON THE SYSTEM OF PUBLIC EDUCATION IN THE DOMINION, WITH SPECIAL REFERENCE TO THE PRESENT PROVISION FOR INSTRUCTION IN AGRICULTURAL SCIENCE.

THE general control of public education, and the inspection of all public primary, secondary, and technical schools, are in the hands of the Education Department, which administers the funds provided by Parliament for educational purposes. The Department also controls directly the Native primary schools and special schools of various kinds. The Department classifies all teachers, fixes all salaries, conducts examinations, and prescribes syllabuses of instruction. The direct control of primary schools and district high schools is, however, in the hands of the Education Boards of the nine education districts, each school being also managed by a local School Committee under the Board. The Boards of Education are also in most cases controlling authorities of technical schools, which, however, are directly managed by more or less independent Technical School Boards wherever the importance of the school warrants the employment of a full-time staff. Secondary schools generally are controlled by independent Boards of Governors, subject, however, to the Act and regulations administered by the Education Department, which thus exercises a general supervision over all schools supported by public funds.

The total cost of public education in the Dominion amounts to about £3,250,000 per annum, of which less than £200,000 is provided from reserves revenue, over £3,000,000 being paid from parliamentary votes.

PRIMARY SCHOOLS.

Primary education is free and compulsory for children between the ages of seven and fourteen. The primary-school life of the children extends normally over a period of about eight years, between the ages of five and thirteen, but no child may leave school before gaining a Sixth Standard certificate of proficiency unless he has reached the age of fourteen years. Statutory provision exists for increasing the age-limit of compulsory attendance at school to fifteen years.

The primary-school syllabus includes subjects of instruction grouped under the general headings of—(1) English, including oral and written expression; (2) "Graphic" expression, including drawing and handwork; (3) Arithmetic; (4) Man and nature, including nature-study, geography, elementary science, and home science; (5) Man and society, including history, civics, and moral instruction; (6) Physical training, including physical exercises, swimming, and lessons on hygiene and health.

No attempt is made to treat any of the subjects from a vocational point of view, the aim of primary-school instruction in the subjects included under heading (4) not being directed towards any particular

occupation, but rather towards awakening the interest of children in natural phenomena, inculcating a love of nature, and also giving an elementary training in scientific method.

The nature-study and elementary-science work in the primary schools is, however, generally supervised by instructors who have had special training in agriculture and agricultural science, and in this way these studies are given a practical flavour, which is, moreover, reinforced by actual practical work in the school-garden, and, in some districts, in the home plot cultivated by the child in connection with agricultural-club competitions.

JUNIOR HIGH SCHOOLS.

Legislative provision was made in 1924 for the establishment of junior high schools which should form a connecting-link and trying-out field between the primary school and the secondary school. Such schools provide a three-years course for pupils who have qualified for attendance by gaining a certificate of competency of Standard IV of the primary-school course—*i.e.*, the curriculum is intended to cover what has ordinarily been the last two years of the primary course and the first year of a secondary course. All pupils in the junior high school are required to take, for approximately half the school week, the same instruction in the subjects of the primary-school syllabus; for the remainder of the school week the pupils take, according to the decision of the Principal after consultation with the parent and the head teacher of the school previously attended, a supplementary course of instruction taken from the following: Academic, manual, commercial, agricultural, art, or other approved course. Provision is made for a change of course.

It is not intended that the supplementary course shall be vocational in character, but rather that it shall be designed to discover the special aptitudes of pupils, with a view to their transfer from the junior high school to a suitable calling, or to an appropriate higher educational institution, at the end of the three-years course. One such school is being established at the present time in a country district, but no information is yet available as to the character of the course in rural science which will doubtless be a leading feature of its curriculum. A junior high school may be placed under an Education Board (and School Committee) or under a High School or Technical School Board.

PUBLIC INSTITUTIONS FOR SECONDARY EDUCATION.

In addition to the junior high school, three classes of full-time post-primary schools are provided for under the Education Act—namely, district high schools, technical high schools, and secondary schools.

A district high school is a public school having a primary department in which primary instruction is given, and a secondary department in which secondary instruction is given. A district high school is governed by the Education Board and School Committee. District high schools are established mainly in rural centres where only a moderate demand for secondary instruction exists. The headmaster manages both secondary and primary departments, and receives extra salary on account of the secondary department, in which special

secondary assistants are employed. A district high school may be established where there is at least twenty prospective secondary pupils.

Technical high schools are full-time day schools providing secondary instruction, including vocational and technical courses. A technical high school is not usually established unless at least one hundred secondary pupils are qualified and willing to attend. Such schools are usually under the direct management of a Technical School Board, which may be under the general control of the Education Board of the district.

The term "secondary school" is restricted to schools of more academic type, usually possessed of special endowments and governed by an independent Board of Governors. Substantially the same qualification for free admission is required in all post-primary schools, the minimum qualification being a Sixth Standard certificate of proficiency or its equivalent, which entitles the holder to free secondary education for two or three years, according to circumstances, while at the end of two years the pupil may qualify for a further period of free tuition up to the age of nineteen years.

About two-thirds of all the pupils in Standard VI in the primary schools proceed to free tuition in post-primary day schools under these conditions. The courses in secondary schools and district high schools are usually taken in preparation for the Public Service Entrance and Matriculation Examinations, and preponderance is given to the more academic types of studies. In the country district high schools, however, provision is made by regulation that all boys holding junior free places—practically all boys in the first two years—shall take practical agriculture and dairy science for at least two hours weekly, unless equivalent instruction of a vocational character is otherwise provided. In most of the secondary schools also provision is made for training in elementary agricultural science, and in many cases practical work is also done in the field. In some of the technical high schools, particularly in country districts, prominence is given to the agricultural course (the Feilding Technical High School, for example, definitely calls itself the Feilding Agricultural High School).

The course in agriculture in all post-primary schools is usually under the direction of instructors who have specialized in agricultural science and possess either a degree or a diploma in agriculture. In the district high schools the work is supervised, and often largely done, by the itinerant instructors in agriculture appointed by the Education Boards to take charge of the supervision of nature-study and elementary science in the primary schools. There are, however, some sixty-eight district high schools and about 2,570 primary schools, while the number of itinerant instructors in agriculture employed by the Education Boards is only about twenty-five, so that in the main the science and agriculture must be taught by the permanent staff, with, in many cases, little or no personal assistance from the itinerant instructors in agriculture except by way of rare visits, and during refresher courses held from time to time, sometimes at a State farm, where the instructors under the Department of Agriculture are also available.

In the secondary schools and technical high schools the subject is in the hands of specialists with training in farm practice and agricultural science, several of whom hold the Bachelor of Science degree

in addition to a degree or diploma in agriculture. The agricultural course is not at present popular, being taken by a comparatively small proportion of boys in post-primary schools—not probably by more than one in ten—in spite of the fact that over 30 per cent. of boys leaving secondary schools go farming. Even in technical high schools, where courses in preparation for vocations are specially encouraged, there is a strong demand for instruction in the subjects which are regarded as the best from the point of view of the Public Service Entrance and Matriculation Examinations. In the Matriculation Examination the subject of agriculture may be taken as an alternative to botany or physiology as the second half of the subject of natural science, which is itself an optional subject in the examination. For the Public Service Entrance Examination, agriculture is also an optional subject, ranking, however, with physical science and home science, while dairy science is also included as a separate subject, ranking with hygiene, geology, botany, and zoology.

HIGHER AGRICULTURAL EDUCATION.

A University course in agriculture, leading formerly to the B.Sc. in Agriculture and latterly to the B.Ag., has been in existence for more than twenty years, the Canterbury Agricultural College at Lincoln having been recognized by the Senate for many years as a School of Agriculture.

The statute in operation some twenty years ago required that students should matriculate and then take a four-years course, keeping terms for two years at a University College, and thereafter for two years at a recognized School of Agriculture, and should, in addition to keeping terms by attending lectures and passing the college examinations, also hold a certificate from the School of Agriculture of having passed an examination in practical farm-work. The University examinations for B.Sc. in Agriculture at that time included fifteen subjects, as follows: (1) Mathematics and mechanics; (2) Physics (as for the B.Sc. degree); (3) Chemistry (as for the B.Sc. degree); (4) Biology; (5) Mechanical drawing (as for the B.Sc. in Engineering). (These five subjects could be taken at the end of the second year, or even one section at the end of the first year, at a University College.) (6) General principles of agriculture; (8) Botany; (9) Physiography and meteorology; (10) Entomology; (12) Mechanics applied to agriculture. (These five subjects could not be taken before the end of the third year.) (7) Practical agriculture; (11) Veterinary science and hygiene; (13) Agricultural chemistry; (14) Book-keeping; (15) Surveying and levelling. (These five subjects could not be taken before the end of the fourth year.)

In the year 1915 agricultural science was introduced for the first time as an optional subject in the Matriculation Examination. Certain changes were also made in the prescription for the degree in agriculture, which is now called the B.Ag. The subject of mathematics and mechanics was removed from the syllabus, but algebra and geometry had to be taken at the Matriculation Examination. The degree course was shortened to three years, including only one year at a University College, the subjects being biology, physics, inorganic chemistry, and organic chemistry to the standard of the medical

intermediate examination, and mechanical drawing. The B.Ag. examination in those five subjects could be taken at the end of the first year, and the remaining subjects at the end of the second or third year, but not more than six subjects in any one year. In place of the second year at a University College the student was required to do in some year outside the three years of the course such practical work as the Director of the School of Agriculture might prescribe, and to hold a certificate from the School of Agriculture of having passed an examination in practical work. In 1916 agricultural science was made an alternative to botany or physiology as the second paper in the optional subject of natural science for the Matriculation Examination, and it has so continued ever since. In the prescription for the B.Ag. examination the subject of farm engineering (including heat engines) was substituted for mechanics applied to agriculture of previous years.

Few alterations have since been made in the B.Ag. course, and none in the half-subject of agriculture for the Matriculation Examination, but in 1922 the subject of agricultural science (two papers) was introduced into the list of optional subjects for the B.A. pass examination, a practical certificate being required as for other science subjects.

In 1924 a professorship in agriculture was established at Victoria University College, Wellington, as the result of a gift of £10,000 by the late Sir Walter Buchanan, and a professorship in agriculture is being established in Auckland University College as the result of a bequest of £20,000 from the late Sir John Logan Campbell. The University Senate has recognized both these colleges as Schools of Agriculture.

TRAINING OF SPECIALIST INSTRUCTORS IN AGRICULTURE.

Provision is made by way of agriculture bursaries for students wishing to become instructors in agriculture under the Education Department. Such bursaries may be held at a State experimental farm, an Agricultural College, a University College, or other similar institution under public control in New Zealand approved by the Minister of Education for the purpose. Candidates must have taken a satisfactory agricultural or rural course at a post-primary school and have passed the Matriculation or an equivalent examination.

TRAINING OF TEACHERS.

Provision is made in the teachers' training colleges for some instruction in agricultural science so that teachers may be better prepared to link up nature-study in the country schools with farm experience, and to follow the suggestions of the itinerant instructors. The training of teachers for this work is also continued by the itinerant instructors in most districts by means of short refresher courses held during vacations and, where possible, at a State demonstration farm, so that the assistance of the experts in the Agriculture Department may be obtained. In addition, regular weekly instruction is given to pupil-teachers in science, including dairy science and agriculture, at Saturday classes conducted in suitable centres throughout the Dominion, and often taught by the itinerant instructors in agriculture. The subjects of agricultural science and dairy science are two among

six optional subjects for the Teachers' Class D Examination, and two among twenty optional subjects for the Teachers' Class C Examination. The Class D Examination is the lower qualification, and corresponds in standard, roughly, to the Matriculation Examination. More than 80 per cent. of classified teachers in primary schools hold either the D or the C certificate.

II. NOTES ON THE FUNCTIONS PERFORMED BY THE DEPARTMENT OF AGRICULTURE IN RELATION TO INSTRUCTION IN AGRICULTURE.

The main part taken by the Department of Agriculture in agricultural education, besides the administration of the Ruakura Farm School, referred to elsewhere in this report, has been that of diffusing knowledge by means of more or less direct advice given to producers by the general staff of the various divisions of the Department, aided by its scientifically trained officers. Though its functions were originally purely administrative, the Department, having an intelligent and progressive farming community to deal with, has gradually evolved methods by which a considerable section of the officers engaged in the duties imposed by the various Acts which it has to administer have now become a medium for conveying to producers practical knowledge, based upon scientific facts or conclusions, for the purpose of enabling them to cope to the best advantage with the various animal and plant diseases or pests for the repression of which the legislation entrusted to the Department's administration is designed. The system is by no means uniform throughout, neither is it complete; but it does, on the whole, prove of marked value to producers, and it is satisfactory to note that, as instruction has increased, the necessity for inspection has diminished.

Apart from this combination of instruction with inspection, certain more or less exclusively instructional services are maintained.

The lately established Fields Division is almost entirely devoted to instruction, its field officers' duties consisting mainly of advising farmers, often upon the farm itself, on matters relating to crops, pastures, fertilizers, &c. The keenness of the demand for the services of these officers well illustrates the usefulness of their work. The Dairy Division has its dairy instructors advising and assisting dairy-factory managers, its farm dairy instructors acting in co-operation with dairy factories in advising and assisting dairy-farmers to furnish clean milk, and its milk-testers doing their part towards building up better yielding herds. The Horticulture Division has its orchard instructors and apiary instructors, both combining instruction with inspection. The Live-stock Division has a large staff of inspectors, many of whom now combine instruction with inspection; field veterinarians who give much instruction and advice to pastoralists and dairy-farmers on matter pertaining to animal health; poultry instructors; a wool instructor; and an instructor in swine-husbandry.

Side by side with this work, investigation and research are carried on in the field in close co-ordination with, and based upon, the activities of the three laboratories—veterinary, chemical, and biological—maintained at headquarters by the Department. Each of these establishments is staffed by capable officers, well equipped with

scientific knowledge, who work in conjunction with the field officers, thus enabling the results of laboratory work to be tested out and given practical effect in the field. The Biological Laboratory staff has been considerably increased in late years, and a fourth laboratory, associated with the Dairy Division, and intended to deal with matters of dairy-produce manufacture, is being established. These laboratories have done good work in assisting to meet the requirements of the quickly expanding primary industries in the direction of investigation and research. It is recognized that due regard has been given by the Government to their requirements as to staff and equipment, and no doubt, in view of the present-day realization of the necessity for assisting agricultural education and aiding the further development of the resources of the land, provision will be made for any necessary further growth on sound lines, both as regards staff and accommodation, of these valuable branches of the Department's activities.

Further lines of instructional work lie in the short courses for farmers given in country centres—mostly in the off-season. These are organized by the Fields Division, and officers of all branches of the Department take part in giving lectures and demonstrations to the farmers attending. These courses, termed "farm schools," each occupying about a week, are evidently appreciated by farmers, and they constitute a distinctly valuable means of instruction.

Boys' and girls' agricultural clubs are also conducted in some districts in conjunction with local farmers' organizations, with the assistance of the Education Department, the Department of Agriculture bearing most of the cost. An expansion of this means of instruction is anticipated.

The large State farms at Ruakura and Weraroa have been responsible for much demonstration work, which has proved in itself of great educational value to producers. In addition, a number of smaller farms and experimental and demonstration areas are established in suitable rural centres. Also, two demonstration dairy farms, financed and managed by local enterprise, are assisted by advice from the Department's officers and aided financially by subsidies from the State.

REPORT.

Board of Agriculture, Wellington, 27th July, 1925.

To the Hon. the Minister of Agriculture.

SIR,—

In your letter of 20th February you express the wish that the Board of Agriculture should make an inquiry as to the steps which should be taken to give more adequate attention to agricultural education, as follows :—

With reference to the question of agricultural instruction, the Government is desirous of having a full inquiry made into all phases of it, including the extent to which further instructional facilities in the form of an Agricultural College or Colleges need to be provided in order to adequately meet the requirements of the Dominion as a whole. The matter has been discussed in Cabinet, and a decision arrived at that your Board should be asked if it would undertake this inquiry.

The order of reference will be as follows :—

(a.) What new agricultural training institution or institutions are required in order to provide facilities in accordance with the Dominion's present-day requirements for the efficient training of—(i) Students desirous of taking a

University degree in agriculture, fitting them fully to become either instructors or research workers in agriculture; (ii) students desirous of becoming farmers, well equipped with a knowledge of the principles of scientific agriculture as applied to the work of practical farming in all its branches ?

(*b*.) The probable number of students of the kind mentioned in sub-paragraph (i) of (*a*) that could be utilized in New Zealand after taking their degrees.

(*c*.) How such an institution or institutions should be equipped as regards staff, laboratories, and farming-land.

(*d*.) Where each or any of such institutions should be situated in order to serve most efficiently the present requirements of the Dominion as a whole.

(*e*.) To what extent, and under what conditions, could the Canterbury Agricultural College be utilized (subject to the approval of the Board of Governors) as an integral portion of the general scheme.

(*f*.) What estimated Government expenditure would be involved by giving effect to the Committee's recommendations regarding paragraphs (*a*), (*c*), (*d*), and (*e*) immediately above.

I appreciate the fact that the members of the Board are all more or less busy men, and that it may be a matter of some difficulty for them all to find sufficient time to devote to this inquiry, but it is felt that, with the knowledge already in their possession, and their intimate knowledge of the requirements of the Dominion in the matter of agricultural instruction, they are well equipped to go into the whole question to the best advantage, and to advise the Government as to the course which should be adopted in establishing a higher and better system of agricultural instruction than exists at the present time.

It was further decided to ask the Board to associate two responsible Government officers representing the Education and Agriculture Departments respectively with it in the inquiry. I should be glad if the Board would undertake this responsibility, and commence its sittings for the purpose at as early a date as is quite convenient to you and to its members.

Full discretion will be given to call evidence, visit existing educational institutions, Government farms, &c., and generally to do any acts which may seem necessary or desirable in order to enable information to be obtained and fully consider a report to be prepared for the information and guidance of the Government.

The Director-General, Department of Agriculture, will be pleased to confer with you at any time with a view to making detailed arrangements as to procedure and any other matters which require to be settled in connection with the conduct of the inquiry.

The Hon. George Fowlds represented the Senate of the New Zealand University, Dr. C. J. Reakes represented the Agriculture Department (at times, in his unavoidable absence, Mr. A. H. Cockayne took his place), and Mr. W. S. La Trobe represented the Education Department.

In compliance with your wish, the Board held a series of meetings for the purpose of taking evidence on the subject, commencing on the 4th March at Wellington, and continuing at Auckland, Wellington, and Christchurch. At each place educational authorities gave evidence, and public notification was given that the Board would hear any other evidence on the subject. During the course of our visits we inspected Ruakura Farm in connection with the instruction given to lads in agriculture. At Auckland, Orakei was viewed, as it was stated that some 50 or 100 acres of this land would be allocated to the Auckland University College Council. Calling at Levin on our way to Wellington, we made a thorough inspection of the Agriculture Department's Weraroa Farm. We then visited the Wairarapa to see the farm given by the people of the district for the training of returned soldiers who wished to go on the land. Evidence was taken as to the suitability of these two latter farms as a site for an Agricultural College. At Christchurch further evidence was taken and

a representative of the Otago University Council stated the views of his Council, so that the Board had the advantage of hearing the opinions of the four University College Councils on the subject. The Board paid a visit to Canterbury Agricultural College, inspecting the buildings, meeting the staff, and inquiring as to its needs. The Board's meetings were adjourned at Christchurch on the 19th March, and members returned home.

To complete the itinerary the Board reassembled at Waipawa on the 22nd April in order to take evidence from Hawke's Bay witnesses and to visit the Smedley Estate, which was bequeathed to the Crown by the late Mr. Josiah Howard for agricultural education.

Returning to Wellington on the 23rd April, the Board inspected the Biological Laboratory of the Department of Agriculture at Kelburn, and later the Wallaceville Laboratory and farm. The remainder of the time in Wellington was spent in the consideration and final adoption of the report. The Board concluded its sittings on this inquiry on the 27th April.

In order to be in a position to answer the questions in the order of reference it was first necessary for the Board to ascertain officially the extent and quality of the provision now made by the Departments of Agriculture and Education by way of agricultural instruction. Representatives of each Department were invited to give evidence, and submitted full information, which is summarized in the preface to this report.

Having in mind that the schools are the nurseries of future farmers, farm training-college pupils, and University students in agriculture, the Board went fully into their relation to agriculture, with a view to discovering not only the extent to which subjects relating to the agricultural industry were taken in the schools, but more particularly as to how far the general curricula of the schools and the work of the teachers were directed towards fostering an understanding and love of country life and country occupations; how far, in short, the education system was being used to oppose the "drift to the town." In this connection the evidence showed that though agriculture was taken seriously in many of the secondary schools, and though considerable sums had in many cases been spent on laboratories and equipment, yet on the whole agriculture was not a popular subject, various reasons being assigned by different witnesses to account for this disconcerting fact. The Board was thus led to a consideration of various matters not definitely included in the order of reference, but having a direct bearing on the question of agricultural education. In regard to some of these the Board would like to express its opinion. Before doing so, however, it will endeavour to give answers to the specific questions set out in the order of reference.

DEFINITION OF TERMS.

During the course of the inquiry it became evident that much misconception existed in regard to the various teaching institutions, and the Board considered that it would be well to define the meaning of the names adopted in this report as follows:—

In the recommendations of the Board—

College of Agriculture means a college either associated with a University College or an institution recognized by the University

Senate. It would in either case be under the government of a Council associated with the Senate, for the purpose of—(i) Training students in the science of agriculture so that they may become teachers or instructors, or (ii) permitting those who intend to become farmers to take a course leading to a diploma or degree if they so desire, or (iii) carrying on "extension classes" for farmers, teachers, or others interested in the industry of agriculture.

Farm Training College, or vocational school, means a farm school under the control of the Department of Agriculture or any properly representative authority which may be established by the Government for the purpose of training students desirous of becoming farmers, well equipped with a knowledge of the principles of scientific agriculture as applied to the work of practical farming in all its branches.

Agricultural High School means a technical high school established under the control of a Board of Managers, on which Board the Education Board of the district is represented, for the purpose of training pupils leaving the primary school and wishing to study the science of agriculture in conjunction with the subjects of a general secondary education.

Primary school means a public school managed by a School Committee under the Education Board of the district, in which primary instruction is given, including training the pupils to take an interest in agricultural matters by means of nature-study and observation.

REPLIES TO QUESTIONS IN ORDER OF REFERENCE.

QUESTION (*a*).—What new agricultural training institution or institutions are required in order to provide facilities in accordance with the Dominion's present-day requirements for the efficient training of (i) students desirous of taking a University degree in agriculture, fitting them fully to become either instructors or research workers in agriculture ?

In discussing this question the Board was confronted by the difficulty that whereas on the one hand three University Schools of Agriculture are now recognized by the University of New Zealand (two in the North Island having been recently approved by the Senate, in addition to the Canterbury School of Agriculture at Lincoln, which has been recognized for many years), on the other hand it was overwhelmingly clear from the evidence brought forward that one fully equipped School of Agriculture of University rank could easily provide for a much larger output of trained experts with degrees in agricultural science than would probably be required to cope with the demand for many years to come. It was, however, equally clear from the evidence that a School of Agriculture has other important functions to perform besides that of training experts in agricultural science, especially in a new country as yet incompletely brought into profitable and agricultural pastoral conditions.

All witnesses, particularly those actually engaged in farming or directly connected with the industry, stressed the urgent necessity for investigational work on the many practical problems which vex the farmer in every branch of his business. The Board realized, therefore, that the establishment of professorships in agriculture in the several University Colleges, and the development of research stations, such as the Cawthron Institute in Nelson, would have, apart

altogether from the question of training undergraduates, direct results of the utmost value to the farmers, and consequently to the whole Dominion, while, indirectly, the status of the profession of farming would naturally be raised, and a higher regard for the life and calling of the farmer would be fostered in the community.

Bearing these matters in mind, the Board hopes that due encouragement will be given, in the University Colleges and other research stations, to the training of research students, especially on the agricultural side, and that it may be found possible to provide, in connection with one or more of these institutions, special facilities for post-graduate training in agricultural research work.

As regards the major question of what new provision should be made at the present time for training students desirous of taking a University degree in agriculture, the Board, while fully appreciating the difficulty created by the recognition by the New Zealand University Senate of three University Schools of Agriculture, is clearly and definitely of opinion that one fully equipped and fully staffed residential College of Agriculture will be sufficient for many years to come, and that such an institution should, when established, be placed in a central position in New Zealand. The Board does not recommend that such a complete and fully equipped institution be established immediately, for reasons given in reply to question (*f*).

The Board recommends that in the meantime, in order to provide for the efficient training of students of agriculture attending Victoria College, the Biological and Chemical Laboratories of the Agriculture Department should be transferred to Wallaceville, and that they and the existing Veterinary Laboratory and the proposed Dairy Research Laboratory should be made available for the instruction of students, to the mutual advantage of the students and the Department; further, that class-rooms and students' laboratories should be provided there for the purposes of the students' training.

The Board further recommends that the Ruakura Farm Training College be made available for co-operation with the Auckland University College in assisting in the provision of instructional facilities for students.

QUESTION (*b*).—What would be the probable number of students of the kind mentioned in (*a*) (i) that could be utilized in New Zealand after taking their degrees?

It was shown in evidence that while the number of agricultural instructors could be largely increased in the Departments of Education and Agriculture with advantages which would probably fully justify the additional expense, it was unlikely that the demand within and without the service for experts in agricultural science would for some years warrant a large output of qualified men. In Melbourne, for example, the total number of students in the agriculture degree course is about thirty, and the demand is so small that the Government has to guarantee positions in order to get students to take the course. In Sydney University the numbers are approximately the same. In America, on the other hand, as Professor Richardson, of Melbourne University, has pointed out, the Agricultural Colleges have flourished greatly during the last twenty years, after a history of forty years of failure. Apparently the American colleges became a success when

the farming community found itself compelled to take full advantage of scientific training made available to the individual farmer by the extension work of the colleges; and it may be doubted, in view of the experience of Melbourne and Sydney, and of America in its earlier development, whether such a condition yet obtains in this Dominion or is likely to arise for some years. In the meantime the evidence indicates that if ten graduates were turned out yearly when the arrangements suggested by the Board were in full working-order, this is about the maximum number that could be employed as teachers, instructors, or research workers. Some doubtless would be otherwise absorbed by the industries of the land, and there is a wide scope in New Zealand for the scientifically trained agriculturist.

With a view to encouraging students to proceed to a degree in agriculture, the Board is of opinion that as far as possible only men with a degree in agriculture should be appointed as teachers of agricultural science in schools or as field instructors. There is an insistent demand on behalf of the farmers for field instructors, and although it was stated in evidence that a man who had just obtained his degree was not in most cases immediately suited to the position, and that more experienced men were needed, yet it is felt by the Board that a University degree should be as essential for such teachers and instructors as matriculation is for entering the University. The young graduate in agriculture, like the young doctor who takes a position in a hospital by way of novitiate in his profession, must, however, serve his apprenticeship to the business of agriculture after providing himself with the essential intellectual equipment. While, therefore, sufficient employment hardly exists at present for ten new graduates per annum, we think that a demand would arise when Government Departments, Education Boards, and the public became educated to employing men who had taken degrees. Dr. Lotsy stated that in Holland the Doctors of Agriculture are chiefly engaged in farming, and no doubt in time the same would come to pass in New Zealand. He also stated that any teacher in primary or high schools who took the special teachers' diploma in agriculture was paid an additional salary whether he was engaged in teaching agriculture or other subjects, and that in consequence nearly all male teachers made it their business to get the diploma in agriculture. The Board thinks that a similar provision might well be made in New Zealand.

QUESTION (*a*).—What new agricultural training institutions are required . . . for the efficient training of (ii) students desirous of becoming farmers, well equipped with a knowledge of the principles of scientific agriculture as applied to the work of practical farming in all its branches ?

The evidence showed that there is a desire among farmers to have more Farm Training Colleges established, but the number of students offering hitherto has not been sufficiently large to justify the establishment of many new institutions. It may perhaps be argued—and the fact that Lincoln College has a waiting-list supports this view—that the lack of prospective students is due to the lack of Farm Training Colleges, and that if more Farm Training Colleges were established they would become better known and more popular; but the Board, after careful inquiries, was inclined to think that the

number of students offering would increase rapidly if a shorter and more intensive course of instruction were adopted. The Board found that pupils spent about half the time in actual farming operations, but that, though there was no doubt as to the quality and adequacy of the instruction given, the work done differed in some essential conditions from that which had to be performed on an ordinary farm, with the result that the boys could not get enough practice under commercial conditions, as to skill, speed, and output, to justify the time spent in practical work on the farm.

As the capital invested in Ruakura Farm as a whole amounts to some £1,500 per student, it is clear that the cost of sufficient land and plant at a Farm Training College to enable the boys to train for practical work under conditions approximating to those of the ordinary farm would be prohibitive. The Board thinks that such a course would be otherwise impracticable, being of opinion that the boys must learn the business of farming under commercial conditions after leaving the Farm Training College. Holding this view, the Board is unable to recommend that boys should spend any large proportion of their time at a Farm Training College in actually performing farming operations. We consider, however, that for boys intending to become farmers a short preliminary course of instruction at a Farm Training College, in general occupying, for seasonal reasons, at least one complete year, and covering the operations, management, economics, &c., of farming, would be of considerable value, especially if it were followed up at intervals by short courses of instruction at the Farm Training College or elsewhere after the boy has gone to work on a farm.

The Board recommends that the work of Farm Training Colleges should be arranged so that—(1) The course should be shortened as much as possible; (2) the field-work should consist mainly of demonstrations of correct methods in farming and in the breeding and management of live-stock; (3) the laboratory and class work should occupy a considerably larger proportion of the time than it does at present. The course would then form a short intensive preparation for boys leaving school and intending to go farming.

The adoption of such a curriculum in Farm Training Colleges would enable these schools to deal with far larger numbers than would be possible under present conditions, so that the capital invested per student would be greatly reduced. The Board is decidedly of opinion that institutions such as Ruakura Farm Training College and Canterbury Agricultural College, to be of real value and to be capable of such expansion as will meet the needs of the Dominion, must be rearranged so as to take at least double the present number of students. As the students become available, provision for training should be increased. In the meantime we recommend that, in addition to the proposals regarding Hawke's Bay (referred to below), Penrose, near Masterton, should be developed into a Farm Training College, seeing that the farm and quarters sufficient to accommodate twenty-six students are already available. Local interest in the matter has been evidenced by the presentation of land and by a large deputation of farmers who met the Board at Penrose.

The question of the government of Farm Training Colleges was regarded by the Board as a matter of considerable importance. The management of Farm Training Colleges is in the hands of the Department of Agriculture, but as the Education Department has special experience of the education of young students we are of opinion that it should be associated in the management of these institutions, especially in connection with arranging the curriculum and the teaching staff. The Board therefore recommends that a Board of Governors for Farm Training Colleges be set up consisting of the Hon. Ministers of Agriculture and Education, one member of the Department of Education, one member of the Department of Agriculture, and three members of the Board of Agriculture, which would include the President. Local Advisory Boards of, say, three members should also be appointed in connection with each Farm Training College, to act in conjunction with the Principal of the College.

Smedley Estate.—The Smedley Estate, which was bequeathed by the late Josiah Howard to the State for the purpose of training in agriculture, consists of 7,000 acres, practically all in grass. It is situated about twenty-four miles from Waipawa, the nearest town on the railway. It is reached by a good road as far as Tikokino, but for some distance farther the road is indifferent for heavy traffic. Mr. Howard did not leave any clear statement as to his wishes how to assist education, but it is gathered from evidence that he thought the estate would itself be used to give the boys of poorer parents the opportunity of free education and experience in farming matters. The situation and character of the land, the Board thinks, preclude it from being used for this purpose. There are various estimates of what the land and stock are worth, but managed as at present it is bringing about £4,000 a year, and there is an accumulated fund of £17,000. Suggestions were made that the property should be sold or leased, and the money invested so as to provide an income to be spent on agricultural education. The Board, however, recommends as the wisest course that it should be continued as at present under the supervision of the Department of Agriculture. When it was taken over there were many improvements needed to put the estate in order, but to-day the estate and stock are well managed, and the income from the estate should be of great assistance to agricultural education in Hawke's Bay. In order to carry out the wishes of the testator a sum of £1,300 per annum should be allocated from the income, £1,000 for twenty-five bursaries of £40 each to enable Hawke's Bay lads exclusively to receive a training in agriculture, and the remainder for a scholarship or scholarships to enable a selected Hawke's Bay student or students to go to a University College to take a degree of B.Ag. If the whole of the £1,300 were not used in any year any balance should revert to the trust.

The Board further recommends that suitable land be procured for a Farm Training College in Hawke's Bay, to be developed as soon as the success of the other Farm Training Colleges demonstrates the need for such a college in Hawke's Bay; this land to be utilized as a demonstration farm in the meantime.

QUESTION (c).—How should such an institution or institutions be equipped as regards staff, laboratories, and farming-land ?

As, in the opinion of the Board, the time has not arrived for the establishment of one great School of Agriculture of University rank, the questions of staff, laboratories, and farming-land were not specially considered. It was clear from the evidence of experts that a considerable staff of professors and lecturers would be required, involving an annual cost of at least £10,000 for teaching alone, in addition to the annual cost of hostels and farming-lands, which could hardly be expected to be self-supporting, at any rate in the early stages of development of the college.

As regards Farm Training Colleges, the Board makes the following recommendations :—

1. *Staff.*—The staff would consist of the following: The College Principal; an agricultural graduate for every thirty students; a farm overseer capable of teaching and demonstrating farm practice; skilled farm-workers specially selected so as to give instruction in farm handicrafts; a horticulturist; besides a domestic staff to deal with the management of the hostel.

2. *Equipment.*—The laboratory and class-room facilities should be sufficient to render the teaching as concrete as possible and to enable the proportion of time at present devoted to laboratory and class-room work to be largely increased in accordance with the Board's recommendations above.

3. *Farming-land.*—Having in mind the type of training which it thinks should be given at a Farm Training College, the Board considers that a large area of first-class land need not be used. Sufficient land to grow all necessary crops and carry enough live-stock to provide adequate facilities for practical demonstrations is all that the Board would regard as essential. For these purposes it is considered that 200 acres of first-class land, or its equivalent, would suffice.

4. *Curriculum.*—The Board recommends that the main subjects dealt with at Farm Training Colleges should be soils, fertilizers, crops, live-stock breeding and management, farm-management, farm economics, and horticulture.

Special emphasis was placed on the importance of sound training in connection with farm economics by many witnesses with wide experience in farming matters; while, as regards horticulture, the Board wishes to stress the opinion that no agricultural training would be complete without instruction in horticulture, and that therefore special provision should be made in Colleges of Agriculture and in Farm Training Colleges for this purpose. The Board is strongly of opinion that, apart altogether from its commercial importance and prospects, the æsthetic value of horticulture amply justifies its inclusion in the course of agriculture.

In regard to Ruakura Farm Training College, the Board, when inspecting the college and seeing the pupils at work, was impressed with the necessity for additional teaching facilities, and Mr. La Trobe was asked to go into the question and report to the Board. His report, which was endorsed by the Board, is appended, and the Board trusts that its recommendations will be agreed to.

QUESTION (*d*).—Where each or any of such institutions should be situated in order to serve most efficiently the present requirements of the Dominion as a whole ?

The Board, being of opinion that the time has not yet arrived for the establishment of one great School of Agriculture, decided not to express a definite opinion as to the particular locality in which it should be situated, beyond recommending that it should be placed in a central position in New Zealand. Mr. G. L. Marshall dissented from this view, and defines his opinion in an addendum to this report.

As regards the location of Farm Training Colleges, the Board's recommendations are contained in the answer to question (*a*) (ii) above.

QUESTION (*e*).—To what extent, and under what conditions, could the Canterbury Agricultural College be utilized (subject to the approval of the Board of Governors) as an integral part of the general scheme ?

The Board expressed the opinion that in order to be of real value and to be capable of such expansion as to meet the needs of the Dominion the vocational training must be rearranged so that the number of students completing their course each year should be at least doubled. This recommendation, while it referred mainly to Farm Training College students, assumed that degree students also would consume a much less proportion of their time at the college in actual farm-work, than is the custom at present, and that accordingly more laboratory and class-room accommodation should be provided. The Board, having inspected Lincoln College and taken note of the investigational work in progress, especially in connection with plant-breeding (towards the cost of which the Department of Agriculture at present makes an annual grant of £500), is strongly of opinion that such work should be continued and expanded. The Board therefore recommends that an additional sum of £500 per annum be granted to Canterbury Agricultural College to enable it to continue and expand its plant-breeding and investigational work, and that a further sum be granted to provide a new laboratory and class-room for the accommodation of additional students.

QUESTION (*f*).—What estimated Government expenditure would be involved by giving effect to the Committee's recommendations regarding questions (*a*), (*c*), (*d*), and (*e*) above ?

As in the opinion of the Board the time has not arrived for the establishment of one great School of Agriculture, the question of the cost has not been considered in detail, but from the evidence submitted by expert witnesses the Board estimated that it would be considerable, possibly involving a capital outlay of £250,000 for land, buildings, and equipment, besides a large annual expenditure for salaries, maintenance, and other incidentals. The Board recommends that when the number of students offering is sufficiently large this work should be undertaken.

In the meantime, if the Board's recommendations relative to the provision of class-rooms and laboratories at Wallaceville for the Victoria College agricultural students are carried out, we think that a sum of £15,000 would be required for this purpose, apart from

the expenditure which would be incurred by the Department of Agriculture in providing for the transfer of its Biological and Chemical Laboratories to Wallaceville.

As regards the needs of Canterbury Agricultural College, we are of opinion that a sum of £20,000 should be provided to bring it up to the standard of modern requirements, in accordance with the Board's recommendations above.

The question of expenditure in Auckland in the matter of laboratory buildings and equipment must remain for future consideration when the school is in existence.

As regards Farm Training Colleges, the immediate needs at Ruakura are dealt with in the special report furnished by Mr. La Trobe and appended hereto. The cost of the necessary buildings and equipment is estimated at £2,100.

At Penrose the necessary additional buildings immediately required are estimated to cost £7,000, the details of which will be provided later.

(To be concluded in next month's "Journal.")

TRIALS WITH ARTIFICIAL FARMYARD MANURE AT LINCOLN.

IN the *Journal* for February last Mr. M. J. Scott, Chemist at Canterbury Agricultural College, Lincoln, gave an account of the making of artificial farmyard manure, and of a trial undertaken on mangolds, at the College farm during last season. Referring further to the matter, Mr. Scott supplied the following note under date 11th September, 1925:—

"We regret to have to report that the results of the trials with artificial farmyard manure on mangolds are inconclusive. Weighings for the manured plot on the south side of the control gave a decrease of 17 per cent., while on the north side there was an increase of 13 per cent. in favour of the manure. Both results are barely significant, and in the case of the lower figure the increase amounts to about 2·9 tons of roots per acre. Since the recent rain, when the south side of the paddock has been a sheet of water, we are convinced that this variation, which masks the effect of the manure, is due to seepage, throughout the year, to the lower end of the paddock. The season of 1924–25 was remarkable for very little rain till October, and for fairly heavy rain till the end of January. The absence of result is due to this unexpected inequality of the ground, to the fact that only one strip was taken in the paddock, and that the ridges went across this strip and made it necessary to take weighings on strips wide apart instead of on contiguous strips. This season we have replicated the plots in such a way as to be able to take weighings off plots that are side by side and evenly distributed all over the paddock. We have also included cattle-made dung in the trial. Results will be recorded in due course."

SEASONAL NOTES.

THE FARM.

FORAGE CROPS.

LAST month's notes on autumn and summer forage crops will be largely applicable to November in respect of sowings, especially having regard to the backward spring season experienced in most districts.

The sowing of rape will be in full swing next month, governed largely as to date by lamb-fattening requirements. A favourite practice in Canterbury, and one which usually gives excellent results for lambs, is to sow a mixture of rape and oats through alternate coulters of the drill, the rape at 1½ lb. to 2 lb. and the oats (either Duns or Algerians) at about 1 bushel per acre.

Sowing of the main turnip crop will be an important item of November farm practice in the South, though in districts subject to the depredations of the grass-grub beetle it may be considered advisable to somewhat delay the operation. The coming month is the recognized time for sowing the still essential swede crop in Southland and South Otago. In many parts the yield of swedes is only moderate, owing to lack of cultivation and insufficient manuring. A crop of 40 tons per acre on 10 acres is a much better proposition than a 20-ton crop on 20 acres. Endeavour should be made to produce a heavy crop on a restricted area rather than a poor crop on a larger area. A more generous application of fertilizers in the case of swedes seldom fails to show a satisfactory return.

Carrots like deep cultivation, and may be grown in a great variety of soils, but do best in a free loam. For cattle-feeding, Matchless White, White Belgian, and Sinclair's Champion are still the best among the standard varieties. Unfortunately, the last named appears to have deteriorated during the last few years, and generally does not produce the roots it used to. If a fair-sized area is to be put in carrots they should be sown in drills 21 in. to 26 in. apart, in order to allow of horse cultivation. If the area is small, and the cultivation to be done by hand, they may be grown in 14 in. to 18 in. drills. Seeding is at the rate of about 1 lb. per acre. Manures similar to those recommended for mangolds, at 3 cwt. to 5 cwt. per acre, will be found suitable. When carrots are being grown for sheep-feeding, the Guerande variety is best. These should be sown, for preference, in drills 21 in. to 26 in. apart, at the rate of 1½ lb. of seed per acre. They should be given intercultivation but not thinned. About the middle of November is the best time to sow this variety.

Maize may be sown when danger from frost is past. The Ninety-days variety is among the best for green feeding, seeded at from 1½ to 2 bushels per acre. The seed should be buried at least 1½ in., and guarded so far as possible against birds.

Japanese millet requires a sheltered position to give good returns, and should not be sown too early—any time after the middle of November in the warmer districts, and the first week in December in colder situations. Sow through every coulter of the drill 16 lb. to 20 lb. of seed, and manure with superphosphate at 2 cwt. to

3 cwt. per acre. To get the best from millet, feeding should start when the growth is 6 in. to 9 in. high, and the crop should be fed off in breaks. Treated thus it will give a number of feedings.

LUCERNE.

Areas intended to be sown in lucerne should be persistently cultivated, with a view to germinating as many weed-seeds as possible before sowing in November or December. A fine, firm seed-bed should be secured, and an application of 1 ton crushed limestone or 10 cwt. burnt lime per acre while working the land is advisable. The ground should not be ploughed again after liming. Inoculation, by spreading about 3 cwt. per acre of soil from a well-established stand, should not be neglected unless there is distinct evidence from previous sowings that it is unnecessary. This practice must be regarded as a very desirable guarantee of the presence of the essential organism. The distribution of the inoculated soil should be done on a dull day and be followed by a stroke of the harrows. An application of from 1 cwt. to 2 cwt. of superphosphate per acre at seeding has much to recommend it.

Young stands from previous autumn sowings will frequently be covered by annual weeds such as fat-hen, yarr, &c. This growth should be mown close to the ground before seeding of the weeds takes place, and the process may need to be repeated. If the lucerne is reasonably clean, however, it should be allowed to get well grown before being cut.

TEMPORARY PASTURES.

The present is a good time for the sowing of temporary pastures. A mixture of 30 lb. Italian or Western Wolths rye-grass and 5 lb. or 6 lb. cow-grass per acre, together with 2 cwt. of a good phosphatic fertilizer, will give a great yield for grazing or feeding out. In general, a spring-sown pasture has a higher clover content than an autumn-sown one.

MAIZE-GROWING FOR GRAIN.

Among the chief reasons for the falling-off in yield per acre of cob-maize in those districts where it has been grown for many years are the loss of soil-fertility, fouling of the land with weeds, and neglect in seed-selection. Generally maize is grown several years in succession, and the land is then sown in pasture, or, too often, left neglected till required for maize again. The result is a crop of weeds, and especially of twitch, the common species in the east-coast districts of Auckland Province being Indian doob.

For the purpose of helping to maintain soil-fertility, and at the same time smother out weeds on land that has been cropped for maize several years, there is nothing better than a spring sowing of oats and red clover, or oats and vetches, at the rate of 2 bushels of oats and 6 lb. to 10 lb. of red clover or 1 bushel of vetches per acre. This crop not only helps to smother out weeds, but after the oats are fed off or cut for hay or chaff the clover or vetches can be fed off, and eventually ploughed under preparatory to again cropping with maize. Such a crop ploughed under builds up the humus-supply, adds nitrogen to the soil, and assists in holding water, while at the same time preventing the growth of weeds.

But the phosphate and potash supply must also be kept up, and for this purpose artificial fertilizers pay handsomely on the maize crop. A mixture of six parts of superphosphate, three parts of Nauru rock phosphate, and one part of sulphate of potash, at the rate of 3 cwt. to 5 cwt. per acre, will be found excellent for heavy land, while the rock phosphate may be replaced by blood-and-bone on lighter soils. On light soils the objection to too much cultivation in the endeavour to rid the land of twitch is overcome to a large extent by the use of smother-crops between successive crops of maize.

After-cultivation of the growing maize with the horse-hoe must be frequent if it is to be effective in keeping down weeds, aerating the soil, and conserving moisture. Soon after planting, it is best to cultivate deeply to deal with weeds, but as the plants grow the danger of destroying lateral roots increases, and the cultivation must then be only 2 in. to 3 in. deep. This may be continued until tasselling begins. The 42 in. to 48 in. row, allowing of more and later cultivation, is favoured where dry conditions may be expected.

Careful and efficient selection of cobs for seed while the crop is still standing, together with an interchange of seed among farmers growing and selecting the same strain of a variety that has done well in the district and become acclimatized, will probably do more to raise the average yield than the haphazard introduction of new varieties from outside the district. Such varieties soon become cross-fertilized and lose identity unless kept away from all other maize.

THE SUMMER FALLOW.

In Canterbury and other districts with similar conditions November is probably the best month of the year for commencing the usual summer fallow of some portion of the farm in which twitch of various kinds is making its appearance. The plough seems to hold its own as the implement for this work. The objective to aim at is the exposure of the rhizomes of the twitch to the maximum weathering. This necessitates the ground being left as rough as possible, and the use of any implements such as harrows or disk harrows tending to produce a fineness of the surface is to be avoided.

The absolute desideratum is to keep the rhizomes (underground stems) endeavouring to produce leafage. So long as this state of things exists the plant is using up its store of food material. The appearance of the leaf marks the commencement of replenishment of food, and consequent rejuvenation. The cultivator should aim at producing conditions as near as possible to those described, and before greenness appears twitch-infested land should be given a cross-ploughing or rough grubbing to expose a fresh portion to the weather.

A successful summer fallow might well be followed by a sowing of rape or mustard, about February, for a green manurial crop. Any quick-growing crop cheap to sow will be an advantage, and although little is known of the economic aspect of green-manuring in this country, observations indicate that beneficial results are likely to be maintained for a considerable number of years.

FIELD DRAINAGE AND PASTURE-GROWTH.

The lack of efficient field drainage has been very apparent on many farms this year, and plans should be made to correct this fault in time for next season. The amount of moisture which has to be removed by evaporation in many cases in the early spring, before the soil can become sufficiently warm for good growth, is enormous, and while the stiffer and heavier soils remain undrained, just so long will it be necessary to submit to late growth and a consequent short season. The position may be eased somewhat by the provision of greater quantities of supplementary fodders to carry on later into spring, but the most profitable method is to encourage earlier spring grass by drainage, together with liming and top-dressing. —*Fields Division.*

THE ORCHARD.

SPRAYING FOR FUNGUS DISEASES.

WET-WEATHER conditions early in October mean that growers are seriously handicapped in the fight against black-spot at the cluster and pink stage of blossoming, and close watch will be needed during the setting-period for signs of the disease. It may be necessary to apply the subsequent sprays at closer intervals in an endeavour to combat infection, and possibly bordeaux may have to be resorted to on the harder varieties; 3–4–40 to 3–4–50 will be found the most useful mixture for pears and apples respectively. When again reverting to lime-sulphur care must be taken that the interval is not too close, and that weather conditions are very suitable at the time of application. Avoid spraying if rain is threatening, and also if very hot and windy, as scorching sometimes results under such conditions. It has been found satisfactory to use one of the non-caustic sulphur pastes following a bordeaux spray, and then reverting to the lime-sulphur again for the next spray. Where the usual lime-sulphur programme has been in use, continue with this spray at 1–100 plus the combination given in last month's notes where desired, or the straight-out sulphur pastes at increased strengths on the tender varieties.

Brown-rot is sure to be prevalent in stone-fruits owing to the bad weather during the blossoming-period, and careful attention must be given to this disease by spraying with lime-sulphur, 1–120, plus 4 lb. to 6 lb. of a sulphur paste, or self-boiled lime-sulphur, 8–8–50. As soon as possible after setting has taken place thinning of the fruit should be undertaken to remove affected and other surplus fruits, as it is found that fruits in clusters are the most affected. The diseased fruit and twigs removed should be destroyed as soon as gathered.

Spraying for other pests should be along the lines set out in former notes.

THINNING, PINCHING, ETC.

Stone-fruits will now be getting well set, and thinning should receive attention. Burbank and Evans Early plums are two varieties which it pays to thin heavily, more uniform ripening and greater size being secured, which returns good value for the time spent. Space peach and apricot fruits well, as size is enhanced and the loss by brown-rot minimized. The removal of blossoms from the new wood of all

apple-trees and from two-year-old wood, also from weakly trees, will assist growth.

The pinching of surplus and misplaced shoots can also be attended to at this time. As new grafts break into growth an inspection should be made and ties severed, but the coverings should not yet be removed. Pinch new growths on the stocks. It is not always advisable to remove all of them entirely at first on vigorous stocks. Be careful to save some of the well-placed shoots. If misses are obvious, these can be budded or grafted on to next season so as to balance the tree again.

The matter of support for overcropped and weakly trees should receive attention early. It is less damaging to the developing crop and also assists in cultivation. A system now rather favoured is to prop up the limbs into position, encircle the tree at the desired height with a galvanized wire of about 12 gauge, and then remove the props. On strong limbs where the pressure is greatest insert a buffer between the wire and limb. Pieces of discarded hose, split and slipped on the wire, are good for this purpose.

CULTIVATION.

The disk harrows should be used freely during the early part of the season. This implement chops the ground deeply and paves the way for the cultivator and harrows later on, when a fine mulch is the big factor in retention of moisture should the weather set in dry. Be careful to work the soil back to the roots of all trees from which it may have been washed during the winter and spring rains. Failure to do this is the cause of many trees being less robust than those more favoured.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

An endeavour should be made to secure a good cultivation as early as possible. Plough and cross-plough where this has not been done. Dig up all odd strips of land and area round trees, afterwards maintaining a good tilth by the use of the hoe under trees, and horse implements between the rows.

Sprays: Where, owing to the delayed condition of the trees, bordeaux has not been applied for verrucosis at petal-fall stage, this may still be done at 4-4-40 mixture, and a repeat spray of the same is advisable on trees which have been sprayed earlier in the season. Owing to the prolonged flowering-habit of the lemon-tree, two or more sprays are necessary to ensure reaching the bulk of the fruits at the correct stage.

Scales and thrips: In order to secure full control of these pests the following sprays are necessary throughout the season: Oil, 1–40, when the sap moves in the spring; oil, 1–40, late October; oil, 1–100, plus nicotine sulphate, 1–800, early December and late January; oil, 1–40, when the trees are in autumn growth—say, early April. Many growers are inclined to rely on oil in spring and autumn only, but the condition of trees proves that these two sprays are not sufficient, both thrips and young scales becoming established in the long interval. The 1–100 oil, plus nicotine, 1–800, will, however, satisfactorily deal with them.

Reworking: Nearly every grove contains one or two drone trees—trees which refuse to fruit or have other undesirable habits. These should be worked over to a better strain, which may be done by budding at this period.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

LATE HATCHES WITH NATURAL MOTHER.

ALTHOUGH the correct season has now passed for hatching out chickens it is safe to assert that many poultry-keepers, especially those on a small scale, will be making their first attempt to secure chickens in order to replace at a later date the old unprofitable stock. In the majority of such cases the natural mother will be employed. This is in itself a distinct advantage as compared with cases where artificial means are adopted; nevertheless if the young birds are to develop into payable stock they must be given special attention from first to last.

In the first place, it is important to see that the hen is not troubled with vermin. A common cause of hens leaving their eggs just before they are on the point of hatching is because they are pestered beyond endurance with lice. Especially in cases where the coop has been previously used for cooping fowls it should be well cleaned, and every crack and crevice sprayed with a disinfectant to make sure that no red mite is present. The hen herself should be dusted with insect-powder before being placed on the eggs, in order to free her from vermin that live on the body. These precautions against parasitic life should be periodically repeated during the rearing stages; but the hen should not be powdered just after the chicks are hatched, as the powder may get into their eyes and blind them.

Every care must be taken to protect the hen and her brood against accidents. The coop should be both cat and rat proof. The nest should be arranged in such a way that when the baby chicks leave the nest they are able to get back. Many chicks are lost annually by getting into a deep water-vessel. This risk can be minimized by using a shallow tray, or, better still, a special fountain made for the purpose of watering chicks.

The coop should be well ventilated, as plenty of fresh air is an essential requirement for both the mother hen and her brood. In order that the young birds may have an opportunity of running on to fresh ground (a great essential for their welfare) the coop should be made in such a way that it can be conveniently moved on to fresh ground every few days. Do not forget that shade is specially demanded by the growing bird at this period of the year, while an abundance of green stuff and a regular supply of clean water are of equal importance.

LEG-WEAKNESS IN BROODER CHICKS.

Several inquiries have been received lately in regard to leg-weakness —generally as regards brooder chicks at from three to four weeks old. This trouble is usually the result of huddling, due in most cases to insufficient warmth being provided in the brooder. The young birds, feeling the greater need of warmth, will huddle together in corners, each one trying to secure an inside position, which is naturally the warmest. Thus with the constant pressure on the undeveloped legs they soon spread, and as a result an affected bird will present a wobbling walk in its endeavour to move about. Unless preventive measures are resorted to, a gradual loss of leg-power will take place, even although the bird appears to possess normal health in all other respects.

While an insufficient degree of heat is the first thing to induce huddling and consequent spreading of the legs, the latter trouble will be greatly intensified if the floor of the brooder is made of smooth boards, and especially if there is insufficient bedding-material thereon. The constant slipping on the smooth surface obviously soon tends towards an abnormal condition of the delicate legs. There is really no cure when a bird becomes badly affected, and very often the only satisfactory treatment is to destroy it. This is one of those many cases in connection with poultry-keeping where prevention is the only way of fighting the trouble. A comfortable degree of warmth in the brooder is the first essential, and then care must be taken to see that plenty of bedding-material is provided. Where the floor of the brooder is made of smooth boards a piece of single sacking the full size of the brooder should be neatly placed in it. This will give the chicks a foothold in the event of their huddling.

The successful rearing of chickens depends largely on the attention given to numerous details, the most important of which is to see that the degree of heat instinctively demanded is always available. Even the most modern makes of brooders are not foolproof. Unless the attendant is observant and regulates the heating and ventilation according to the requirements of the chicks, especially when extreme weather conditions prevail, failure in some way or other is almost certain to follow.

THIN-SHELLED EGGS.

The production of thin-shelled eggs is a common occurrence at this period of the year, when the great majority of the birds are giving a maximum egg-yield. This trouble is usually due to insufficient shell-forming material being supplied, or to the birds being overforced with rich foods, such as meat, milk, &c. As a preventive an ample supply of crushed sea-shell or broken burnt bone should be available to the birds at all times. If this does not bring about a desired improvement the only other safe course is to feed less of the forcing ration.

As to the method of supplying crushed shell, or, indeed, grit of any kind, some people make the mistake of providing these materials in a narrow receptacle into which the birds can merely put their heads. A much better plan is to place the material in a wide box, or even on the ground, so that the birds are given an opportunity of scratching it about and picking out the pieces they like best. Especially is this necessary where both gravel-grit and sea-shell are mixed together. It must be remembered that the laying bird will consume more than double the amount of shell in proportion to grit. Thus it will be readily seen that owing to the latter being in the way and the birds being unable to remove it, they may easily be prevented from securing the necessary egg-shell-forming material so much required by them, especially during the heavy-producing season. —*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FEEDING AS A SAFEGUARD.

In many districts there is a distinct break in the honey-flow from the cessation of the willow and fruit bloom until the clover makes its appearance. It is during this period that the bees must be carefully

watched, not only to see that they are not dying of starvation, but also to provide for a sufficient increase in young bees which will develop into field workers by the time the main honey-flow arrives. Gently stimulative feeding is the best course to adopt at this period. The quantity of syrup fed will depend largely upon the strength of the hives. If feeding has to be resorted to, the sugar-syrup may be fed in a less concentrated form than that which is given in the autumn and spring months, the quantity of water being increased. A syrup fed in the proportion of one part of sugar to six of water is all that is required, and will be the means of keeping the colonies strong in brood and bees. The invariable rule should be observed to always feed in the evening and inside the hive.

VENTILATION.

No set time can be given for increasing the size of the hive-entrances, but the action of the bees should be noted. If in cases where the entrances were contracted in the autumn to prevent the intrusion of mice they have not been already widened, they should be attended to at once. Proper ventilation during the working season is an important item in bee-management, as it relieves large numbers of workers from the duty of fanning during the hot weather. In extreme cases it may be necessary to elevate the hive-body by placing 1 in. blocks between it and the bottom-board. This should be sufficient to meet all requirements.

SUPERING.

Preparations should now be well in hand for enlarging the hives. This may be done when the brood-chamber is getting full of bees, and the operation should be carried out in mild weather. Do not wait until the bees are cramped for room, but anticipate their wants and add supers when they are required. Where drawn-out combs are used, no trouble will be experienced in inducing the bees to enter the supers. It often happens that no combs are available, in which case sheets of foundation must be used; but the bees will not always take readily to these unless there is a good flow of honey coming in, and a little encouragement will have to be given to induce them to enter the supers when only foundation is used. Should the bees fail to start work in the supers, elevate one or two frames of honey from the brood-chambers, at the same time inserting in their place sheets of foundation from the super. Do not bring excluders into use at this season, as the bees will rarely work foundation in the supers when they are used. Much time is lost by this practice, and very little honey will be gathered.

STERILIZATION OF FOUL-BROOD COMBS.

Considerable interest is being manifested in the sterilization of infected combs by the use of formalin and alcohol, and although a certain amount of doubt exists in the minds of many beekeepers as to the value of the treatment, tests in the laboratory are conclusive. Before 1922, when the Hutzelman solution was announced, the practice followed was to melt up all combs from infected colonies. However, since formalin has proved a successful germicide—either with the use of alcohol or water—of foul-brood bacteria, its use may be beneficially applied to the sterilization of extracting-combs. In a recent report Professor D. H. Jones, Bacteriologist, Ontario Agricultural College, sums up his investigations as follows :—

The questions we wished to decide in the following experiments were—first, whether or not Hutzelman's claims could be substantiated; and, secondly, whether or not the use of water as a diluent could be substituted for alcohol with satisfactory results. Accordingly, combs were immersed for twenty-four and forty-eight hours respectively in various dilutions of formalin, alcohol dilutions of formalin, and Hutzelman's solution, after which cultures were made from the larval scales.

X Indicates growth *Bacillus larvae*. o Indicates no growth *Bacillus larvae*.

Disinfectant.	Combs immersed 24 Hours.						Combs immersed 48 Hours.					
	Cultures from Capped Cells.			Cultures from Uncapped Cells.			Cultures from Capped Cells.			Cultures from Uncapped Cells.		
	1	2	3	1	2	3	1	2	3	1	2	3
Formalin 100	o	o	o	o	o	o	o	o	o	o	o	o
,, 50, water 50.. ..	o	o	o	o	o	o	o	o	o	o	o	o
,, 25, ,, 75.. ..	o	o	o	o	o	o	o	o	o	o	o	o
,, 20, ,, 80.. ..	o	o	X	o	o	o	o	o	o	o	o	o
,, 15, ,, 85.. ..	o	o	X	o	o	o	o	o	o	o	o	o
,, 10, ,, 90.. ..	o	X	X	o	o	o	o	o	o	o	o	o
,, 50, alcohol 50.. ..	o	o	o	o	o	o	o	o	o	o	o	o
,, 20, ,, 80.. ..	o	o	o	o	o	o	o	o	o	o	o	o
Hutzelman's solution	o	o	X	o	o	o	o	o	o	o	o	o

It will be seen from the table that in the case of uncapped cells, after twenty-four hours' immersion in all dilutions of formalin used, the spores of *Bacillus larvae* were killed. In the case of the capped cells, however, a few of the spores were not killed in the length of time, either in the water dilutions or in the Hutzelman solution.

After forty-eight hours' immersion, however, all spores were killed in capped cells as well as uncapped cells. Thus in these experiments the water dilutions of formalin proved to be as effective as the alcohol solutions in destroying the spores of *B. larvae* as they occur in the scales of infected brood combs.

On removing the combs from the formalin dilutions, strong odour of formalin persisted on the combs for days. As this odour is strongly objectionable to bees, attempts were made to get rid of it. The method that gave the best results was washing the combs under the tap immediately on removal from the formalin. The combs should be held in a slanting position and passed backwards and forwards and from side to side under the free-flowing tap. In this way all traces of the formalin can readily and easily be removed, after which the combs are stood up to dry.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

In the cooler districts the sowing of French and runner beans may now be made, also marrows and pumpkins. Sow lettuce thinly in drills where it may be allowed to complete its growth. Towards the middle of the month, in the warmer areas, sow broccoli and Brussels sprouts, and savoy cabbage a little later.

The half-hardy plants mentioned in last month's notes may now be set out in the cooler districts. Handle the young plants carefully, disturbing the roots as little as possible. Avoid as much as possible

stunted plants whose growth has been checked by crowding or being allowed to remain too long in the seed-boxes. Discard also plants that are "blind," or that in any way differ from the true type. Do not waste land and labour on putting out cull plants; such cannot be made to give a satisfactory crop. Neither be tempted to plant on land that is unprepared; much better is it to complete the preparation and plant a later crop.

During fine weather hoeing and cultivating the growing crops is of first importance. Too often weeds are allowed to grow large before they are dealt with; the successful grower destroys them before they are visible to the casual glance. These remarks apply to the potato crop, which should be harrowed, if necessary, before the plants are through the ground. As soon as the rows can be seen, put the horse or hand hoes through them; a clean crop is not only bigger, but more easily handled and harvested. Avoid deep cultivation near the plants; to disturb the tuber-bearing growths is to diminish the crop. Defer the final moulding till the plants commence to flower or begin to spread.

Rhubarb and Asparagus Beds.

With the commencement of the summer fruit and vegetable crops the cutting of rhubarb and asparagus should be stopped; and too often these beds are then forgotten. The former is allowed to be overrun with weeds, and the latter, closely planted on land moulded up (a method copied from a country of higher rainfall and heavy, stiff land), with a number of weak shoots only remaining, is allowed to dry out. On the lighter, friable soils of this warmer country this method is uncommercial, and even in private gardens is disappointing.

If the asparagus-beds are weak, cease cutting early and *leave a limited number of strong shoots to each crown.* Apply a good dressing of chemical fertilizers. If in doubt what to apply, make it 2 oz. blood-and-bone manure and 1 oz. nitrate of soda per square yard, and do not allow the beds to dry out during the summer. This should produce a strong growth that must be carefully protected, for it is only by allowing the plant to make a vigorous recovery that a full crop of young shoots of quality may be harvested in the next spring.

Areas in rhubarb should receive somewhat similar attention as soon as pulling ceases for the season. Hoe them well in bright, dry weather, and afterwards apply a dressing of fertilizers and encourage good stout growth, removing all flower-spikes as soon as they appear.

Tomatoes.

Under glass the tomato crop is setting fruit, and every care is needed to avoid anything likely to check the plants, such as houses allowed to become overheated of a morning before the ventilators are opened up, or overventilated on cold nights. Plants treated to extremes of moisture or drought are seriously checked, and show it by dropping their flowers or slow development of the fruit. Worse still, under the conditions of a lowered vitality, leaf-mould fungus and other diseases find an opportunity of becoming established in the absence of that best of all preventives—the natural vigour of the plant.

Towards the end of the month the bottom bunches will be approaching maturity. It is customary then to strip the lower leaves surrounding

the ripening bunch and spread a mulch over the surface of the ground. Should the crop promise to be of exceptional merit, carefully select a few of the best plants and mark them down for seed-bearing. For this purpose, of first importance is it that the plant be of good type and constitution; next, that it carry a reasonably large crop; and, further, that the fruit be of satisfactory shape, colour, and texture. Allow such fruit to become fully ripe on the plant, extract the seed, dry it, and *store the seed from each plant in separate envelopes.*

As stated above, the best preventive of disease is a sturdy, normal plant. Where fungus spraying has to be resorted to, bordeaux mixture, 3–4–50, is the best remedy. Some growers are having trouble with white fly with crops under glass. If taken in the early stages, tobacco spraying or fumigation will meet the case, but if the trouble is extensive sodium-cyanide fumigation may have to be applied. This trouble would be avoided if the house, when empty, was thoroughly cleaned up. Such an opportunity should never be missed after blights or disease of any kind have been present.

SMALL-FRUITS.

In the small-fruit section Cape gooseberries may be planted out. Passion-vines planted out this season will require frequent cultivation to keep down weeds and induce vigorous growth. Stop all laterals and concentrate the growth in the main leaders. Older plants are often pruned towards the end of the month, the fruiting-laterals being cut back, thus sacrificing the summer crop and augmenting the more valuable late crop.

The gooseberry and strawberry harvest will now be commencing. Instruction and close supervision of pickers will well repay the trouble. To clean up all fruit that is ready to be gathered and avoid picking that which is immature requires intelligent application. Strawberry losses from birds will be largely avoided if the picking is commenced in the early morning. Provide separate containers for jam fruit, and avoid as much as possible the necessity of rehandling these delicate berries.

TOBACCO.

Tobacco-growers will be busy putting out the young plants in prepared ground. In doing this every care that is taken to avoid checking the plants is well repaid. Watering the beds before lifting, placing the plants systematically in convenient trays, and keeping them in the shade until the time of planting are some of the considerations that are of value. Replace losses in the field as soon as they are observed, and keep the wheel or horse hoes busy maintaining a clean tilth. Good work of this kind now will minimize the more expensive hand hoeing required when the plants are too big to allow of the machines being used. Remember early planting and growth will ensure an early harvest, when the leaves may be harvested in better condition and curing is facilitated.

WEED-KILLING.

The drainage of yards and roads about the homestead is often interfered with by the growth of grass and weeds blocking water-tables and culverts. A liquid weed-killer sprayed on with a watering-can now while the growth is short will make an effective clearance. A well-tried recipe

is as follows: Place 1 lb. arsenic and 2 lb. caustic soda in a kerosene-tin nearly full of water. Leave it to stand for a few days, and the arsenic will be dissolved, when the mixture may be diluted to 20 or 40 gallons, according to the nature of the weeds to be destroyed. Needless to say, this mixture is poisonous and should be kept in a safe place, as also the utensils used, as they can never be satisfactorily washed and made safe for other purposes again.

LAWNS.

For those who still have weedy lawns to deal with the following recipe will be useful: Dissolve 1½ lb. sulphate of iron in 1 gallon of water. Apply with a watering-can through a fine rose or with a spray-pump. This quantity is sufficient for 20 square yards. It will kill soft weeds and brown the grass, but will not seriously injure it.

Lawns receive great benefit if rolled now when damp, an operation which can, of course, be carried to excess, especially where the grass is short and thin and the land heavy—a very rare occurrence, however. Rolling is of special benefit on light land at this season, and will contribute very materially in diminishing the ravages of the grass-grub.

—*W. C. Hyde, Horticulturist.*

RENAL CONGESTION IN LAMBS.

THIS is a trouble which annually causes a greater or lesser mortality among lambs, and is one which is brought about solely by overnutrition. It is generally the best lambs that are affected, and almost invariably they are single lambs. Twins, having to share the milk of their dam, run less risk of overnutrition and usually escape the trouble. The farmer rarely notices any symptoms prior to the death of the lamb, and his attention is generally drawn to the trouble by finding one or more of his best lambs dead in the paddock.

On making a post-mortem examination of a lamb that has died from this trouble it is found to be in extra good condition—in fact, plethoric—and the kidneys are congested and often in such a pulpy condition that they can hardly be removed.

This condition may occur in lambs when they are between four and eight weeks old, and when the trouble appears it is generally found best to castrate and tail the lambs, as the bleeding from these operations and the shock to the system usually give the animal a "setback," and in this way prevent a continuance of the mortality. Occasionally some lambs die even after these operations have been performed, but these will generally be found to be single ewe lambs in extra good condition upon which the simple operation of tailing has had little or no effect. The ewes and lambs should also be removed to poorer pasture so as to reduce the milk-supply to the lambs. Owners of breeding-ewes should keep this matter in view when the lambs are between three and eight weeks old, especially when they are doing well and the ewes are in extra good pasture for milk-production.

In regard to treatment for an affected lamb, some castor-oil could be given, but treatment is hardly worth while, as at that age and in this condition they soon succumb. The whole trouble is one which can be controlled by management.

—*Live-stock Division.*

Destruction of the Kea.—The subsidy of 5s. per beak which has been paid by the Agriculture Department for the destruction of the kea for some years past was continued during 1924–25. A total of 2,916 beaks were paid for, this representing a decrease of 1,107 on the previous year's figures.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CALVING, ETC., OF DAIRY COWS.

A. B., Otorohanga :—

I am informed that in the case of a cow or heifer calving prematurely the afterbirth will not come away until the date when the cow should calve naturally. Is this so ? In the case of some cows it is impossible to remove the afterbirth without injuring or causing bleeding to take place, so I have had to resort to washing out with a very light solution of Condy's daily. Is the tying-on of a light weight likely to do good ? Regarding the washing-out of cows before being put to bull, do you consider Condy's crystals as effective as most of the proprietary preparations on the market ? If so, please give exact strength to use. Should the cow always be in season when washed out, or would such washing be of benefit at any time ?

The Live-stock Division :—

In the case of a cow or heifer calving prematurely the fœtal membranes are frequently retained. More especially is this observed after cases of abortion; but there is no truth in the statement that the membranes will not come away until the date when the cow should calve naturally. Speaking generally, it is not wise to interfere with a cow having retained membranes for at least a few days after calving. Manual extraction is not to be recommended, except when done by a person who understands the nature of the connection between the membranes and the womb. It must be carefully done, the hand being inserted and the membranes detached (unbuttoned) from the mushroom-like elevations (cotyledons) on the womb. Where this procedure is roughly performed it frequently leads to permanent injury to the womb, and perhaps sterility. In cases of retention the following drench will be found useful: Epsom salts, 12 oz.; powdered ginger, 1 oz.; carbonate of ammonia, 4 drams; dissolved in 3 pints water in which 1 lb. treacle may also be dissolved. The womb should be washed out with a few gallons of solution of permanganate of potash—one small teaspoonful of the crystals to the gallon of water. This treatment is usually effective. The practice of hanging a weight on the membranes usually only ends in causing a portion to break away. Regarding the washing-out of cows before being put to the bull: This is a procedure only to be adopted when there is actual trouble existing, and it should not be indiscriminately carried out. The womb can be properly douched only when the cow is in season, as at other times the mouth of the womb is firmly closed. Potassium permanganate in the strength given is a safe and useful solution to use.

MAKING IRON-AMMONIUM CITRATE.

F. K. WALKER, Paengaroa :—

Please give me instructions for making home-made citrate of iron for iron-hunger (" bush sickness ") in cattle. As I have quantities of lemons it may be worth while making the citrate of iron on the farm.

The Chemist :—

For making iron-ammonium citrate from lemons the juice is expressed and the amount of citric acid determined by analysis. It is then digested with the required amount of freshly prepared ferric hydroxide, and finally the calculated quantity of ammonia is added. The strength of the solution is then found by analysis, as the acidity of different batches of lemons (and consequently the strength of the final solution) varies considerably. It is therefore hardly practicable to make the citrate in small quantities on the farm, unless one has the necessary technical knowledge and suitable apparatus for the work.

STRAWBERRY-GROWING.

"SMALL-FRUITS," Hastings :—

I should be pleased if you could give me any information with regard to the following: (1.) Is there any way of destroying grass-grubs in a strawberry-bed without harming the plants? (2.) What is the best manure for strawberry-plants, the soil where these are planted being fairly rich, with a sandy loam underneath? (3.) Can you recommend any particular kind of strawberry-plant for commercial use (apart from Melba) which has a good rich flavour, also where it is best obtainable?

The Horticulture Division :—

(1.) Nothing is known at present that is effective in destroying grass-grubs in a strawberry-bed without harming the plants. Beds on rather light soil usually suffer considerably from this trouble. (2.) You say nothing of the age or condition of the plants. The following may be tried if the plants have not had a dressing this season: Four parts bonemeal, three superphosphate, two muriate of potash. Apply 5 cwt. to 10 cwt. per acre, working it with the cultivator. This may be followed by a dressing of nitrate of soda, 1 cwt. per acre, when the plants are in bloom. (3.) If you are planting for commercial purposes it is wise to use such varieties as have been proved suitable to your soil and district. If you wish to try others besides Melba and Marguerite, a few Cresswell's Seedling, Phenomenal, and Duke of Edinburgh are suggested. The Auckland nurserymen can probably supply you if your local nurseries have sold out.

ERADICATION OF GORSE.

G. A. BRUCE, Waipu :—

I would feel obliged for any information as to the most effective way of eradicating gorse. The land is mostly ploughable, part river-flat and the rest clay subsoil. Which do you think would be best—to plough deeply so as to bury the gorse well under, or to plough shallow and then when it started to grow again plough it in deep?

The Fields Division :—

Eradication of gorse under the conditions stated may be effected by (1) destruction of plants growing on the area, (2) treatment of the soil, (3) cropping. Grub out the gorse-plants and heap up and burn as soon as the plants are dry enough. If the area is not too large and the gorse-growth not too dense, grub well under the ground. This will help to weaken the root and make subsequent treatment easier. Plough up the area and lime it at the rate of 10 cwt. to 15 cwt. per acre of ground limestone. Sow 3 bushels per acre of Algerian oats with 3 cwt. of superphosphate. This will have a smothering effect on the young gorse-plants. After this crop is taken off put the area into temporary pasture of Italian rye-grass and red clover—25 lb. of the former and 6 lb. of the latter per acre, together with 2 cwt. to 3 cwt. of super. Any young gorse-plants that may appear should be promptly grubbed out. Stocking, especially with sheep, will assist in getting rid of the gorse. Keeping the principle in mind of smothering the gorse after cultivation by cropping, you may suit your cropping to meet your farm requirements.

PIGS WITH NASAL CATARRH.

L. C. G., Matatoki :—

I have pigs which are suffering from nasal trouble. They have difficulty in breathing through the nose, make loud noises as when snoring, and on one occasion I saw bleeding. They developed this trouble during the winter, although their living-conditions were good. It does not affect their appetite, but they are doing poorly. I would be pleased if you can kindly diagnose and give me a remedy for the trouble.

The Live-stock Division :—

Your pigs are evidently affected with a form of nasal catarrh, which, because of the snuffling noise made in breathing, is often called "snuffles." Sneezing and

bleeding from the nose are also symptoms of the trouble. The condition is not commonly met with. It is attributed to cold, wet conditions causing chills. Sties not properly protected from prevailing winds, damp floors, &c., are contributing causes. With improvement in the condition of the pigs the trouble as a rule disappears. An endeavour should be made to build up the animals by extra nourishing diet. A little linseed-meal fed daily is useful. One ounce of cod-liver oil given to each pig, mixed in the feed twice daily, will be found beneficial.

BROADCASTING TURNIPS.

"BROADCASTING," South Norsewood :—

Will you please tell me if I can expect satisfactory results from broadcasting turnips with a hand broadcasting-machine; also the quantity of seed required per acre, and if it is best to broadcast the manure before or after sowing the seed?

The Fields Division :—

We cannot ordinarily recommend sowing turnips with a hand broadcasting-machine, although this has been successful on maiden country, free from weeds, and in good heart, before the advent of the turnip-ridger and the drill. For one thing it is difficult to make proper use of the fertilizer, which under broadcasting-conditions is not concentrated round the roots of the plants. Another point which should not be overlooked on long-established farming-lands is that weed-growth is encouraged through the inability to cultivate broadcast crops during the growing season. However, should you decide to broadcast, the seeding should be about 8 oz. per acre. Apply the fertilizer and harrow in prior to sowing the seed, which will subsequently be chain or brush harrowed.

PRECAUTIONS AGAINST CONTAGIOUS ABORTION IN CATTLE.

"WHATATUTU," Gisborne :—

During the past season the milking-cows on the station were troubled with abortion. They were treated with success. I wish to know if there is any danger of the disease being spread among the station herd by using the same bulls as for the milkers. The station herd (200) is Hereford, the milkers Jersey cross.

The Live-stock Division :—

There is certainly some risk of spreading abortion to the station herd by using the same bulls as for the milking-herd. Though the disease apparently yielded to treatment last season, yet it is almost certainly still present in latent form and liable to recrudescence during the present season. You are therefore advised to use separate bulls for the station cows. If you wish to use the bulls you have at present you would be well advised to take a blood-sample from each bull and post to the Officer in Charge, Veterinary Laboratory, Wallaceville, who will examine them and report to you whether or not they react to the abortion test. A small 1 oz. bottle will be sufficient for each sample. Sterilize the bottle, then make a small cut on the tail, fill the bottle, cork, and label with the name of bull.

THE "FLOWERING-CURRANT" AND CROSS-FERTILIZATION.

G. M. DAVIS, Raetihi :—

I have been told that if what is commonly called "flowering-currant" is grown in the vicinity of red- and black-currant bushes in a few years the fruit-yielding bushes will cease to bear, owing to cross-fertilization with the "flowering-currant." Kindly let me know if this is actually so.

The Horticulture Division :—

The theory stated regarding currant-bushes is interesting, but no evidence to support it has been met with. There are many reasons for the edible-currant bushes not cropping sometimes, but it is extremely doubtful if the vicinity of the "flowering-currant" is one of them.

THINNING A MACROCARPA-CYPRESS PLANTATION.

A. M., Gisborne :—

I have a plantation of macrocarpa, three years planted, and now 8 ft. to 12 ft. in height. The trees are 5 ft. apart. I wish to know at what size or height I should thin them out ; and will the thinnings, if, say, 6 in. to 8 in. in diameter, be durable for posts ?

The State Forest Service :—

A macrocarpa plantation planted at 5 ft. apart would probably require thinning at about eight to ten years after planting. This, of course, would depend on the growth made by the trees during the first years. A general rule which might be followed is to start thinning out the young trees when it is noticed that the crowns of certain trees are beginning to overtop and crowd out the less-vigorous-growing stems. At this stage it might be well to go through the plantation and remove those stems which appear to be getting suppressed, having in view that a gradual opening-up of the crop is to be aimed at, so that the main vigorous-growing trees will receive sufficient space and light to develop. As the habit of *Cupressus macrocarpa* is inclined to be somewhat branchy, this thinning should not be begun until the stems in the crop have commenced to clean each other up—until the lower branches have started to die off and a clean stem has been produced to a height of about 3 ft. to 4 ft. The object in growing a plantation for timber purposes is to stimulate a natural pruning in the crop, and this is produced by growing the trees in close formation in the early stages, so that a complete canopy is maintained and competition is produced amongst the trees of the crop. When this competition results in the suppression of a certain number of the trees the time is indicated for the controlled entrance of more light by means of a light thinning-out of the stands. With regard to the second query, macrocarpa thinnings make admirable temporary fencing-posts if allowed to season for a period of a few months after cutting, the durability period depending on the amount of heart-wood which had been formed by the stems.

BOVINE TUBERCULOSIS.

THE annual report of the Live-stock Division for 1924–25 refers to the incidence of this disease in the Dominion as follows :—

The number of cattle condemned for tuberculosis during the year by Stock Inspectors on clinical examination in the field was 4,881, the Inspectors being thorough and active in their work. The distribution of the condemned stock was: Auckland, 3,021 ; Wellington (including Taranaki, Hawke's Bay, Marlborough, and Nelson), 1,242 ; Canterbury-Westland, 408; Otago-Southland, 210. During the year considerable use was made of tuberculin for diagnostic purposes, and this is a very encouraging sign, as it has been recognized for many years as the most valuable and reliable agent for detecting tubercular animals which do not show definite clinical symptoms. It is being largely used in connection with cows supplying milk for human consumption, and every encouragement is given by the Department to extend it and make its use available to every owner by carrying out the test free of cost. In the results of the examination of carcases on slaughter at freezing-works and abattoirs the percentage of tubercular animals shows a slight decrease. The number of cattle (excluding calves) examined was 397,432, of which 5·41 per cent. were found to be affected in varying degrees, a considerable number only very slightly. The position of the Dominion as a whole in respect of bovine tuberculosis seems to show some improvement when all collateral circumstances are taken into consideration. Generally speaking, it is most prevalent in low-lying wet or swampy areas, particularly in the Auckland Province. Drainage and better farming methods, combined with careful inspection and the observance of all possible preventive measures, will, it is hoped, bring about improvements as time goes on. As regards swine tuberculosis, the position remains about the same as last year.

WEATHER RECORDS: SEPTEMBER, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during September was, on the whole, unsettled, bleak, and squally. Atmospheric pressure was below the average over the Dominion for nearly the whole of the month, and westerly disturbances predominated. Rainfall was therefore above the average in all parts with a westerly aspect, but deficient in most of the east-coast districts. There were several hard frosts in both Islands, and especially on the east coast of the South Island, which, however, experienced very trying weather between the 12th and 14th, when the barometer was highest in the South.

Stormy weather prevailed in most parts from the 3rd to the 8th, when there were some heavy falls of snow in the South Island. Weather conditions were also severe between the 19th and 27th, and the west-coast rivers were in high flood. Some rather severe hailstorms were reported, with occasional thunderstorms.

—*D. C. Bates, Director.*

RAINFALL FOR SEPTEMBER, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
	North Island.			
	Inches.		Inches.	Inches.
Kaitaia	4·64	17	0·94	4·75
Russell	4·70	16	2·08	3·42
Whangarei	5·46	24	1·46	4·88
Auckland	4·60	25	0·87	3·62
Hamilton	5·91	26	0·55	4·37
Kawhia	5·10	24	1·04	4·39
New Plymouth	8·66	27	1·73	5·08
Riversdale, Inglewood	14·85	26	1·78	9·48
Whangamomona	9·72	27	1·25	7·57
Tairua, Thames	5·60	16	1·40	4·64
Tauranga	3·87	20	0·80	4·21
Maraehako Station, Opotiki	2·95	12	0·76	4·28
Gisborne	1·63	8	0·50	3·11
Taupo	7·83	20	1·12	3·71
Napier	0·34	6	0·17	1·75
Maraekakaho Station, Hastings	0·70	13	0·17	2·58
Taihape	4·74	21	0·68	3·72
Masterton	4·28	17	0·57	3·18
Patea	6·00	25	0·95	3·63
Wanganui	4·88	12	0·75	3·05
Foxton	2·88	9	0·58	2·37
Wellington	3·32	19	0·75	4·03
	South Island.			
Westport	7·73	29	0·95	6·82
Greymouth	13·41	27	1·33	8·26
Hokitika	14·01	27	1·38	9·14
Arthur's Pass	29·63	19	7·20	14·96
Okuru, Westland	18·67	18	2·87	12·48
Collingwood	14·76	24	1·52	10·13
Nelson	3·60	20	0·68	3·75
Spring Creek, Blenheim	3·17	18	0·69	2·64
Tophouse	16·69	24	2·56	4·81
Hanmer Springs	6·98	15	2·36	4·58
Highfield, Waiau	3·24	12	1·00	3·35
Gore Bay	2·26	8	0·68	4·28

RAINFALL FOR SEPTEMBER, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Christchurch	3·08	13	0·96	1·75
Timaru	2·08	11	0·54	2·18
Lambrook Station, Fairlie ..	4·50	9	1·98	2·30
Benmore Station, Omarama ..	2·40	17	0·46	2·14
Oamaru	1·59	8	0·79	1·74
Queenstown	3·39	15	0·75	2·52
Clyde	1·20	9	0·40	1·06
Dunedin	3·29	22	0·83	2·74
Wendon	2·64	19	0·52	2·44
Invercargill	5·28	25	1·22	3·00

AGRICULTURE DEPARTMENT'S FARMS AND EXPERIMENTAL AREAS.

FOLLOWING is a list of the farms, stations, and experimental areas at present operated by the Department, together with brief indications of their principal activities :—

Ruakura Farm of Instruction, Hamilton East : General farming and dairying. Stud-stock breeding (Milking Shorthorn, Jersey, and Ayrshire cattle ; Southdown sheep ; Berkshire pigs). Horticulture ; poultry ; apiary. Training-school for youths.

Central Development Farm, Weraroa, Levin : General farming and dairying. Stud-stock breeding (Friesian and Red Poll cattle ; Ryeland sheep ; Berkshire, Large White, and Large Black pigs).

Te Kauwhata Horticultural Station, Te Kauwhata, Lower Waikato : Vineyard and wine-making. Orchard. Black-wattle plantations and bark-mill.

Waimaunga Experimental Farm, Waimaunga, Grey Valley : Dairying ; pastures and crops.

Ashburton Experimental Farm, Ashburton : Cereals, potatoes, forages, and general crops. Lucerne growing and feeding. Soil-fertility-increase trials.

Mamaku Demonstration Farm, Mamaku, Rotorua County : Investigation of "bush sickness" (soil-deficiency affecting ruminant stock) ; dairying and auxiliary cropping.

Wallaceville Laboratory Farm, Wallaceville, Hutt Valley : Field-work in veterinary research. Wool-improvement. Breeding of milking-goats.

Puwera Experimental Area, Puwera, Whangarei : Gum-lands dairy-farming. Pasture-establishment and auxiliary crops.

Albany Experimental Area, Albany, Auckland : Gum-lands cultivation. Pasture plants and forages ; fruit-trees.

Marton Experimental Area, Marton : Cereals and general crops. Pasture-management.

Galloway Experimental Area, Galloway, Central Otago : Irrigation farming. Dairying ; lucerne-growing ; general cropping ; orchard-establishment.

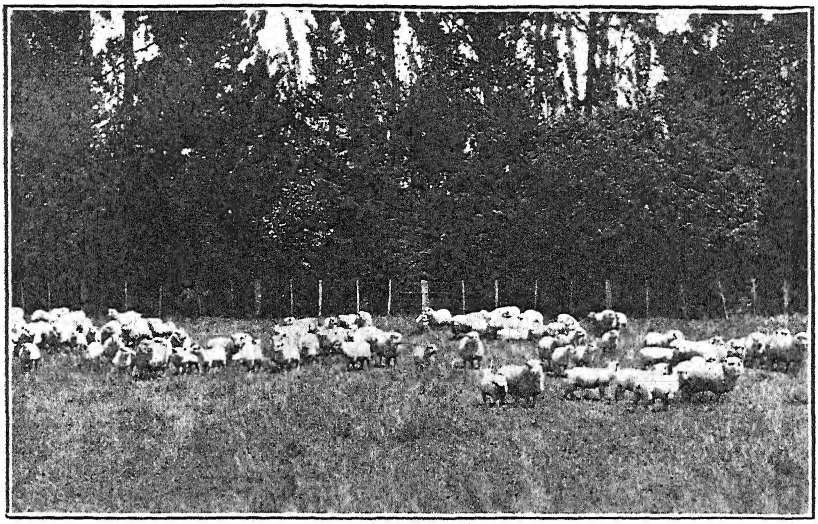
Gore Experimental Area, Gore : General cropping. Root-crop-diseases investigation.

Winton Experimental Area, Winton : Grassland economics ; general cropping.

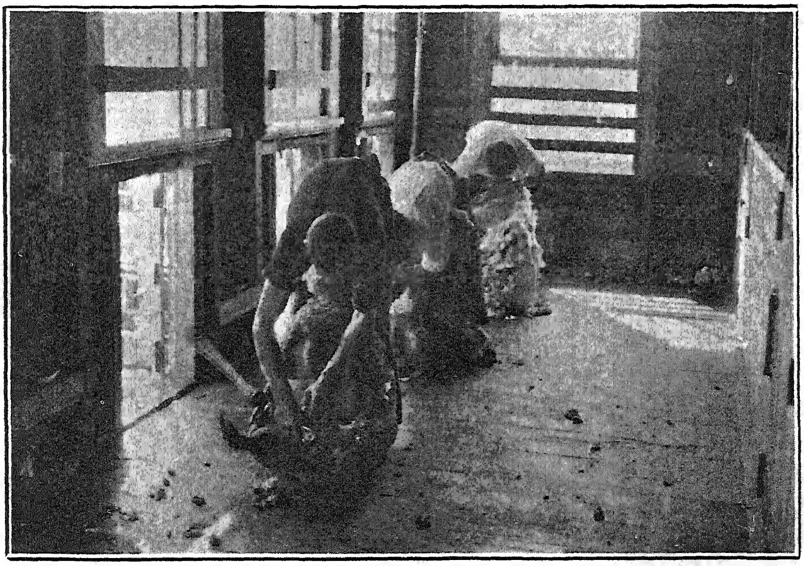
Quarantine Stations : Farming operations are conducted in connection with the live-stock quarantine stations at Motuihi Island (Auckland) and Quail Island (Lyttelton).

Undertakings under local ownership and management, but subsidized and superintended by the Department, comprise the Stratford and Waimate West Demonstration Farms in Taranaki, and the Northern Wairoa Experimental and Demonstration Farm, Dargaville.

A number of experimental plots are conducted by the Department in co-operation with local farmers in different parts of the Dominion.



SOUTHDOWNS AT RUAKURA FARM OF INSTRUCTION.



STUDENTS SHEARING AT RUAKURA.

ANNUAL SHEEP RETURNS AS AT 30TH APRIL, 1925.

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams	580	756	3,686	1,180	4,043	2,155	12,400
Other rams	29,067	89,841	74,568	17,627	72,195	59,881	343,179
Wethers	315,461	663,618	680,410	210,572	547,586	646,016	3,063,663
Breeding-ewes	1,141,516	3,455,416	2,866,803	721,236	3,009,869	2,520,383	13,715,223
Dry ewes	61,775	274,029	200,074	40,622	167,652	139,614	883,766
Lambs	543,845	1,861,330	1,456,766	360,652	1,182,717	1,124,414	6,529,724
Totals, 1925	2,092,244	6,344,990	5,282,307	1,351,889	4,984,062	4,492,463	24,547,955
Totals, 1924	1,968,115	6,277,917	5,232,685	1,272,533	4,711,095	4,313,431	23,775,776

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1916–25.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Sheep of Distinctive Breed not entered in Flock-books, and Crossbred Sheep.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1916	316,131	252,201	15,012	175,155	758,499	3,478,263	12,640,566	1,189,023	6,721,799	24,788,150
1917	329,230	160,212	6,212	114,778	610,432	3,457,824	13,099,957	1,066,435	7,035,738	25,270,386
1918	325,111	171,437	6,297	125,116	627,961	3,696,520	12,850,597	1,592,452	7,770,772	26,538,302
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	12,176,224	1,799,201	7,304,171	25,828,554
1920	306,621	154,516	9,803	109,454	580,394	3,901,742	11,415,159	1,814,391	6,208,284	23,919,970
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	11,989,180	1,336,306	5,724,053	23,285,031
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	12,341,777	952,789	5,618,240	22,222,259
1923	330,055	172,843	9,013	119,749	631,660	2,551,627	12,890,160	808,919	6,199,073	23,081,439
1924	332,814	179,533	9,727	132,137	654,211	2,807,832	12,896,561	1,036,723	6,381,249	23,775,776
1925	355,579	184,744	7,867	131,485	679,675	3,063,663	13,530,479	875,899	6,398,239	24,547,955

NOTE.—Stud sheep returned since 1917 are only those entered in flock-books.

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS, AND OF CROSSBREDS, IN EACH SHEEP DISTRICT (1925).

Breed.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in flock-books)—									
Merino	..	..	..	..	11,089	16,078	530	27,697	27,697
Lincoln	554	1,981	10,934	13,469	1,156	102	851	2,109	15,578
Romney	13,961	12,935	77,790	104,686	10,186	6,259	31,431	47,876	152,562
Border Leicester	314	..	394	708	312	11,325	11,424	23,061	23,769
English Leicester	511	375	255	1,141	1,114	18,706	484	20,304	21,445
Shropshire	444	..	662	1,106	198	2,905	605	3,708	4,814
Southdown	2,083	5,526	21,737	29,346	488	11,101	819	12,408	41,754
Corriedale	552	417	1,118	2,087	773	34,286	6,626	41,685	43,772
Other breeds	250	363	354	967	964	2,332	842	4,138	5,105
Totals	18,669	21,597	113,244	153,510	26,280	103,094	53,612	182,986	336,496
Sheep of a distinctive breed but not entered in flock-books—									
Merino	6,484	3,076	18,622	28,182	209,207	414,047	326,318	949,572	977,754
Lincoln	16,736	62,757	38,591	118,084	10,372	8,445	10,668	29,485	147,569
Romney	261,516	1,139,456	1,082,720	2,483,692	121,805	77,039	357,829	556,673	3,040,365
Border Leicester	5,010	6,837	3,088	14,935	424	26,682	54,799	81,905	96,840
English Leicester	2,907	1,085	698	4,690	8,178	43,988	4,366	56,532	61,222
Shropshire	3,627	95	1,058	4,780	1,756	5,445	2,390	9,591	14,371
Southdown	3,966	16,763	30,538	51,267	1,078	12,837	1,648	15,563	66,830
Corriedale	3,559	3,587	20,302	27,448	16,442	388,804	315,581	720,827	748,275
Half-breds	3,693	1,910	6,383	11,986	228,782	797,405	323,367	1,349,554	1,361,540
Other breeds	1,415	899	670	2,984	95	3,768	256	4,110	7,103
Totals	308,913	1,236,465	1,202,670	2,748,048	598,139	1,778,460	1,397,222	3,773,821	6,521,869
Crossbreds and others not otherwise enumerated	1,764,662	5,086,928	3,966,393	10,817,983	727,470	3,102,508	3,041,629	6,871,607	17,689,590
Grand totals	2,092,244	6,344,990	5,282,307	13,719,541	1,351,889	4,984,062	4,492,463	10,828,414	24,547,955

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Tomoana, 21st and 22nd October, 1925.
Poverty Bay A. and P. Association: Gisborne, 27th and 28th October.
Wairarapa A. and P. Society: Carterton, 28th and 29th October.
Marlborough A. and P. Association: Blenheim, 28th and 29th October.
Timaru A. and P. Association: Timaru, 28th and 29th October.
Manawatu A. and P. Association: Palmerston North, 4th, 5th, and 6th November.
Ashburton A. and P. Association: Ashburton, 5th November.
Northern A. and P. Association: Rangiora, 6th November.
Canterbury A. and P. Association: **Royal Show,** Christchurch, 11th, 12th, and 13th November.
Wanganui Agricultural Association: Wanganui, 11th and 12th November.
Wallace A. and P. Association: Otautau, 18th November.
Waikato A. and P. Association: Hamilton, 18th and 19th November.
Egmont A. and P. Association: Hawera, 18th and 19th November.
Otago A. and P. Association: Dunedin, 18th and 19th November.
Stratford A. and P. Association: Stratford, 25th and 26th November.
North Otago A. and P. Association: Oamaru, 26th and 27th November.
Wyndham A. and P. Society: Wyndham, 4th December.
Auckland A. and P. Association: Auckland, 4th and 5th December.
Waipukurau A. and P. Association: Waipukurau, 22nd January, 1926.
Horowhenua A. and P. Association: Levin, 26th and 27th January.
Rodney Agricultural Society: Warkworth, 6th February.
Dannevirke A. and P. Association: Dannevirke, 10th and 11th February.
Pahiatua A. and P. Association: Pahiatua, 13th February.
Masterton A. and P. Association: Solway, 16th and 17th February.
King-country Central A. and P. Association: Te Kuiti, 18th February.
Northern Wairoa A. and P. Association: Mititai, 20th February.
Tauranga A. and P. Association: Tauranga, 26th February.
Franklin A. and P. Association: Pukekohe, 26th and 27th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 3rd and 4th March.
Mayfield A. and P. Association: Mayfield, 20th March.
Temuka and Geraldine A. and P. Association: Winchester, 25th March.
Methven A. and P. Association: Methven, 27th March.

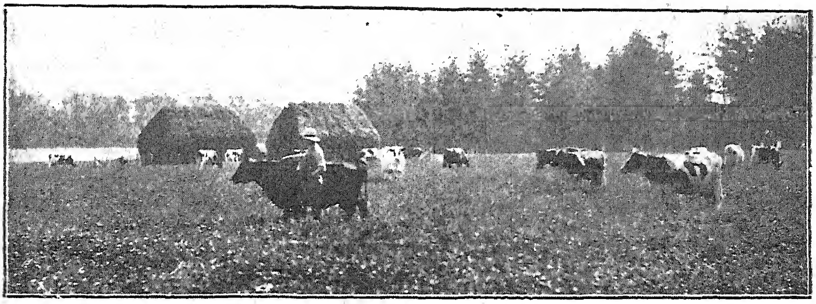
Agricultural and Pastoral Association Secretaries are invited to supply dates and location of their shows for publication in the "Journal."

Poisoning of Stock.—The Chemist to the Agriculture Department reports that an unusual number of cases of poisoning or suspected poisoning of stock were dealt with during the official year 1924–25. Several cases of poisoning by sheep-dips came under notice. In one instance the use of too strong a solution of an arsenical sheep-dip as a wash for lice resulted in the death of five out of six valuable plough-horses. Difficulty has been experienced in dealing with many cases of suspected poisoning of stock, owing to senders forwarding inadequate samples, or samples not properly packed.

Cider.—The manufacture of cider is steadily extending, especially in the Nelson District, where a large quantity of low-grade apples which would otherwise be unsaleable is utilized for making this beverage. The quantity of cider made during the year 1924–25 is estimated as 45,000 gallons, valued at £11,250.

Hops Exports.—The quantities and values of hops exported from New Zealand during the last five years ended 31st March were as follows: 1921, 1,765 cwt., £19,201; 1922, 2,056 cwt., £18,054; 1923, 2,243 cwt., £21,153; 1924, 3,883 cwt., £27,615; 1925, 4,469 cwt., £31,112.

Rabbit Districts.—The constituting of the Rotongata Rabbit-proof Fencing District (Waipa County), for the purposes of the Rabbit Nuisance Act, has been gazetted.



The New Zealand

Journal of Agriculture.

Vol. XXXI.—No. 5.

WELLINGTON, 20th NOVEMBER, 1925.

STATIONARY SPRAYING PLANTS FOR THE ORCHARD.

SOME INITIAL LOCAL EXPERIENCES.

J. A. Campbell, Director of the Horticulture Division.

There are many factors to be taken into account in the prosecution of a successful orcharding business. These include soil, situation, varieties and classes of trees, training and cultural methods, and a reasonably reliable and conveniently situated market; but the primary factor of all is the production of a good clean crop of fruit. Even where this is secured it is not always possible, owing to other handicaps under which the orchardist may have to labour, to make the venture a complete success, but without clean fruit no grower, however favourably situated otherwise, can feel safe or satisfied in this work.

At the present time spraying is recognized to be the one great practical means of disease-control available to the orchardist. Although possibly the ideal formulas have not yet been devised, considerable advancement during recent years has been made in this direction, with the result that the sprays now available can be held to be reasonably effective for the several purposes for which they are intended, if correctly applied.

Great improvements have also been made in the means of application of sprays. Development along this line has ranged through all stages, from the hand-syringe to the latest spraying outfits resembling

miniature fire-engines. But, notwithstanding the latter very effective machines, a further change is likely to become general—in fact, in some parts of the fruitgrowing world this is already the case. I refer to the adoption of stationary spraying plants, several of which have recently been installed in this country.

The development of fruit-culture and the science and practice of orcharding made the use of high-powered spraying plants essential, but with their advent it was found that other unavoidable factors militated against their complete success. Machines of the kind referred to are heavy and cumbersome, and traction difficulties over cultivated ground are not inconsiderable. Following a spell of wet weather, however, particularly if the contour of the land is to any extent uneven, the difficulties become practically unsurmountable until the soil has had some time to dry.

In the control of fungous diseases it is not only necessary to have available an efficient fungicide, but it is equally essential that the fungicide be applied at the correct time. A high humidity is favourable to the germination and growth of fungi, and as the humidity frequently is high following wet and showery weather in the spring and early summer it naturally follows that the danger period often occurs under circumstances that make an otherwise efficient spraying outfit unworkable. These conditions have no doubt tended very materially to the development of stationary spraying plants, for by this means there need be no delay after rain. Further, the work can be rushed through far more quickly, as it is possible to have many more nozzles at work than is practicable under ordinary spraying methods. There are many other possible advantages attending this system as against the use of the mobile power sprayer, not the least of which is the better condition in which the soil can be kept as against the packing that takes place through the hauling of a heavy outfit over wet puggy land.

Stationary spraying means the spraying of an orchard with the engine that provides the power installed at a fixed point. Pipes are laid systematically throughout the orchard, and the material forced through under high pressure. The pipes consist of mains and laterals. The laying of these is largely governed by the shape of the orchard and contour of the land. More is said regarding this in the reports which follow, but the object is to economically yet adequately cover the whole area. Laterals are taken out from the mains at suitable distances apart. There is no fixed rule as to this, but the following general directions should serve.

The first lateral is placed between the fourth and fifth rows of trees, and the remainder along every eighth row from the first throughout the extent of the main. A short standpipe fitted with tap and hose connection is taken up from the lateral close in to the tree-trunks, the first from under the fourth tree from the main, and the remainder every eighth tree from the first throughout the extent of the lateral. Thus sixty-four trees can be sprayed from each standpipe. Of course, an adequate length of hose is required to enable this to be done. Stop-cocks are fixed at the base of each lateral adjoining the main. By this means the spraying-material can be confined to that portion

of the orchard that is being sprayed, thus avoiding the necessity of filling the whole system.

There is still some doubt as to the size of pipes best suited for this purpose. In the State of Washington, U.S.A., where stationary spraying plants are in almost general use, the mains are generally of 1 in. piping, while some are as large as 1¼ in., and the laterals ¾ in. In this country, so far, the mains do not exceed ¾ in., while some are as small as ½ in., and the laterals range from ½ in. to ⅜ in. The larger the piping system the greater the wastage of spraying-material when spraying is completed. At the same time, although the larger pipes are dearer and the cost of installation correspondingly higher, less engine-pressure is required to pass an equal quantity of material through these pipes, and consequently there is a reduced strain on the system. No doubt the small pipes adopted in the Nelson District, even down to the ⅜ in. size, are so far allowing of ample pressure and are giving complete satisfaction, but the strain on the system must be very great. Having this in mind, the possibility of corrosion in the future and further reduction of the carrying-capacity of the pipes make the ⅜ in. pipe a doubtful proposition, and nothing less than ¾ in. mains and ½ in. laterals is recommended.

Several different makes of engines are being used for producing the necessary power. There are some available specially fitted up with pump attached, but any reliable make of engine of 2½ horse-power and upward should serve the purpose.

There are two distinct practices in connection with the stationary-plant system. One is known as the dead-end and the other the circulating system. The latter requires more piping and is therefore more costly to install, but it has the advantage that the material can be kept moving, and consequently there is less liability of the spraying-materials separating while in the pipes, and possibly less likelihood of corrosion; the saving of a certain amount of spray that would otherwise be lost is also effected. However, local orchardists who have adopted the dead end system claim that it is quite satisfactory, and if properly manipulated little loss or settling out is likely to occur. While reason suggests that the circulating system would be the most satisfactory, experience alone, which is at the present time lacking, can determine the point.

The following reports from Messrs. J. H. Thorp and G. Stratford, Orchard Instructors at Nelson and Motueka respectively, give accounts in some detail of what is being done regarding stationary spraying plants in the Nelson Province.

MR. THORP'S REPORT.

Hurst and Stewart's Orchard, Redwood's Valley.

In this orchard there are approximately 28 acres of trees served by pipe-lines through a total length of pipe measuring about 11,000 ft. In half of the area ⅜ in. piping has been laid down, and in the other half ¾ in. mains with ½ in. laterals radiating from them. In actual working the difference in pressure is not great, sufficient pressure being obtained for all practical purposes in either part. Length of pipe from the pumping-stations varies from 80 ft. to 2,440 ft. At the

latter distance, with a pressure at the pump of 280 lb. on the gauge, the pressure at the nozzle is 175 lb., and at the closest point approximately 280 lb. Thus the loss of pressure by friction is about 100 lb. at the farthest point when spraying with one nozzle, and slightly less when three nozzles are operating. But ample pressure is secured to do all that is necessary, and from the appearance of the volume being delivered from the nozzles one would hardly notice the difference.

The working plant consists of a 500-gallon concrete tank, connected to which is a Bean duplex pump driven by a 2-horse-power Lister engine, which drives the pump with ease. The $\frac{3}{4}$ in. main pipe is on the surface of the ground at the highest level of the orchard, and each lateral is equipped with a gate valve, by which means the spray material can be directed down any lateral on which the spraying requires to be done. The hose connections are placed nine trees apart, as also are the lateral pipes, so that eighty-one trees can be sprayed at each shift of the hose. The laterals are buried to a depth of 15 in. near the centre of the lands, and short pipes extended to the tree, with an upright piece of pipe to which the tap is affixed for connecting the hoses. The latter are approximately 120 ft. long, and the nozzles deliver about $\frac{3}{4}$ to 1 gallon per minute each.

The installation of this plant is on the dead-end system—that is, there is no circulation of the spray material except such as is secured by the velocity of the mixture through the pipes to the nozzle, no return to the spray-tank of the surplus mixture being provided for.

Where only lime-sulphur solution is being applied this will be quite right, but it has yet to be decided what will take place when arsenate of lead is added. There are many doubts as to whether the arsenate of lead will settle in the pipes instead of reaching the trees at the longer distances, and a warning has already been given by Messrs. Chamberlain and Stannard, who used the dead-end system last season, that the lead would not remain in suspension long enough to reach the farthest points from the pump. In their case, however, the material was being pumped uphill, while with Messrs. Hurst and Stewart's plant the material is being pumped downhill all the time. In the case of Messrs. Chamberlain and Stannard, it may be mentioned that their system this season has been changed to a circulating one by joining up one lateral to the other and returning a pipe separately to the tank; and a test of the spray mixture of arsenate of lead discloses the fact that the difficulty of settling out of the lead has been practically eliminated.

Mr. Stewart, who has charge of the orchard of Messrs. Hurst and Stewart, is enthusiastic over the results obtained with their plant, as it has enabled him to get the spray on his trees during the recent wet weather when it would have been impossible to get on to the land with horses and spray-pump outfit. With three hoses going it is estimated that the orchard of 28 acres, with 4,500 trees, will be sprayed quite comfortably in three eight-hour days, when the land is worked down, as the hoses will be more easily handled than can be expected over roughly ploughed ground under wet conditions.

Messrs. Chamberlain and Stannard, of Nelson, above referred to, were the pioneers of the piping system in their orchard at Waimea

West, having had 12 acres of their area piped last year. In this orchard the piping is all $\frac{3}{4}$ in., and laid on the surface of the ground, which means that cultivation can only be done one way of the land and the ground cannot be cross-worked.

Stewart Estate Orchards.

Mr. W. R. Hoddy has installed a $\frac{3}{4}$ in. main with $\frac{1}{2}$ in. laterals, and has connected his ordinary spray outfit of $1\frac{3}{4}$ horse-power to same at the top of his orchard of 11 acres. He is entirely pleased with the result. In this case there are no gate valves in the laterals, which Mr. Hoddy now regrets, as he considers it would be more satisfactory to have them, and is already proposing to insert them into the pipes.

Mr. W. H. Ballinger, of Wellington (5 acres), and Mr. A. G. Ballinger (10 acres), whose orchards Mr. Hoddy supervises, have also installed the piping system on the same lines as Mr. Hoddy. In each case it will be worked with the latter's portable outfit.

Mr. R. Simpson has installed a $\frac{1}{2}$ in. piping system on 7 acres of Mr. W. H. Simpson's orchard, the driving-power being a Fordson tractor geared down to suit. He is high in praise of the results obtained and the benefit derived by being able to get on with the spraying as soon as rain has ceased.

On the sloping clay loam country this latter feature alone is a tremendous advantage, as it is sometimes impossible to get over the lowest lying parts for several days with a spray outfit, which is disastrous when fighting black-spot. Added to this is the detrimental effect on the land which is occasioned by the repeated movement of horses and spray-cart over the wet land.

General.

From the foregoing it will be seen that the stationary form of spraying is going to be popular, and there is much to commend it. But there is still much to prove as to which are the best methods to adopt, such as the question of dead-end *versus* circulating systems to secure agitation of combined sprays; to what length of piping the dead-end system can be trusted to ensure suspension of materials, and through what size of pipes; the minimum power required to drive the plant, and which size of pipe, according to the area of orchard and lay of country, will then be the most suitable; also many other details which are varied in the present installations in this and adjoining districts. For instance, it may not in all cases be necessary to put the pipes under the ground. I consider that where the trees are large and the branches stable the pipes might be run overhead through the trees with gate valves and tap connections in convenient positions and always accessible; if $\frac{3}{8}$ in. piping is satisfactory the weight would be very little on the trees. A great deal of information will be available by the end of the season on the subject, and orchardists who intend to go in for the piping system should make opportunity to inspect some of those plants in actual operation, so as to avoid mistakes and obtain definite information regarding details.

MR. STRATFORD'S REPORT.

T. C. Brash's Orchard, Mariri.

The system installed in this orchard is that known as the dead-end, being made up of mains and laterals, but no return to the tank as with the circulating system. It is thought that with the small pipes used, both for mains and laterals, the spray material will be kept in circulation, giving no time for settling; but this has to be proved. I am inclined to think that a certain amount of settling will occur, especially with arsenate of lead. The main pipes are ¾ in., and the laterals ⅜ in., the main being laid due east and west, with laterals running from the main north and south. The pumping plant is placed in a gully, where water is available, there being steep inclines on either side. It is doubtful if sufficient pressure will be obtained on the ridges, and the placing of the pumping plant at as high a level as possible is advisable.

The plant is the Friend 4 horse-power, obtained from the Fruit-growers' Federation, and to all appearances a good outfit, being very compact and running very easily, and there should be no trouble with the working. A magneto has been put in instead of the battery as supplied, as a magneto is held to serve the purpose more satisfactorily. The plant sits on a concrete bed, and takes up very little room.

By the side of the plant is an 800-gallon wooden tank for the mixing of the sprays, thorough agitation being given by three fans driven by the engine. Outside the pumping-station a water-tank holding 600 gallons is placed and connected with the spray-tank inside. This water-tank is kept continually full from the water in the gully. From the spray-tank the spray is driven into the main and laterals, which run underground at a depth of from 10 in. to 12 in., and about 2 ft. from the fruit-trees. A short connecting-piece, the same size as the laterals, at every fifth tree, brings the lateral about 1 ft. above the surface of the ground and as close to the tree as possible. Ordinary household taps are attached to the ends of the laterals.

To prevent any bending of the lateral by the possible pulling of the hose when spraying at the farthest distance away, a stout piece of wire is run through a piece of hose and fastened to the tree. To assist in disconnecting under pressure, an attachment is placed on the ends of the hose, which can be easily unscrewed from the tap when shifting from one tap to another. This attachment also, by means of a shut-off, keeps the spray in the hose while the operator is walking from one tap to another. Stop-cocks are placed on both mains and laterals, so that no spray can travel up the pipes when spraying is not being done in any particular part of the orchard. A length of 100 ft. of light hose is used, enabling spraying to be done to the fullest extent without using the whole length of the hose.

A stationary plant is also being installed in Mr. J. H. Thorp's orchard at Braeburn.

E. T. James's Orchard, Tasman.

This installation is on the dead-end principle, and actual spraying was in progress while I was present. The mains are only ½ in. pipes and the laterals ⅜ in. The pumping-station is placed at the top

of the orchard, all the spray being drived downward, thus reducing the required pressure to a minimum. A pressure of from 250 lb. to 300 lb. was shown on the gauge at the pump when spraying was being done, and was well maintained at the nozzles, the spray leaving them at about the same force as with an ordinary spraying outfit showing a pressure at the pump of 250–300 lb. It appeared as though very little, if any, pressure was lost, and the spraying was being done at almost 1,000 ft. from the plant. In the pumping-station two spray-tanks, each holding 800 gallons, are placed one above the other. From the lower tank the spray is driven into the mains and laterals. Each tank is provided with a good agitator. As the spray from the lower tank is being used, another mixture is prepared in the top tank, and by the manipulation of a valve is run into the lower tank when required. A rotary pump, also driven from the plant, pumps water from a well into a water-tank, from which the top spray-tank is filled as required. Double nozzles were being used. In this system the main from the pumping-station runs east and west, and the laterals north and south for the top half of the orchard, where another main runs north and south with laterals east and west. The couplings on the hose and taps, and the attachment to the tree, are similar in method to those in Mr. Brash's orchard. The 100 ft. of $\frac{3}{8}$ in. hose used did not appear excessively heavy for the operator.

Many local orchardists, realizing the importance of spraying at the proper time, irrespective of the state of the soil, are making inquiries regarding the piping of orchards, and there is no doubt that should the few plants installed this season prove a success there will be much extension in the future. I see no reason why the piping of orchards for spraying purposes should not be successful, and I would strongly advise orchardists to fully consider the question before investing in a new mobile spraying outfit.

Actinomycosis.—The number of cattle condemned for this disease throughout the Dominion in 1924–25 was 851, the condemnations being distributed as follows: Otago - Southland, 79; Canterbury - West Coast, 105; Wellington, 287; Auckland, 380. The Live-stock Division reports that actinomycosis in its earlier stages is amenable to potassium-iodide treatment, and a supply of this drug put up in tabloid form in a suitable strength was obtained during the year, and is available for sale at cost price. In lieu of condemnation, it has been advised that suitable cases be put under this treatment, and numerous recoveries have resulted.

Silage and the Quality of Milk.—Some farmers hold that silage will taint the milk of cows to which it is fed. This opinion has not been confirmed by official feeding trials with silage at Wye (England). "On no occasion," says a report in the *Journal of the Ministry of Agriculture*, "has any bad flavour been noticed, and during the time the 1922–23 trial was being carried out the College herd was included in the Kent clean-milk competition, in which it was placed second. While the competition was in progress the milk was examined periodically by a dairy expert." The fat content was taken regularly during the trials, and the records did not indicate that the change from roots to silage, or *vice versa*, had any definite effect upon the quality of the milk.

CONCRETE-WORK ON THE FARM.

(Concluded.)

A. W. HUDSON, B.Ag., B.Sc., Assistant Instructor in Agriculture, Christchurch.

IN the *Journal* for February last the writer dealt with (1) materials used in concrete construction and their mixing, and (2) the making of posts. It was hoped to convey to those readers not already familiar with the simpler uses of concrete some knowledge of the technique of the work. It must be borne in mind that the designs of concrete structures are many, and that each is usually fitted for some special case. If these articles serve to assist the beginner in the successful performance of some of the easier tasks it is fairly certain that his interest and self-confidence will be sufficiently stimulated to cause him to carry out a greater variety of work. The laying of paths and floors for farmyards and buildings, and the making of troughs, wiii be dealt with in the present article.

3. CONSTRUCTION OF PATHS.

In laying a concrete path the first essential is to define what kind of traffic will be carried, so that the thickness and proportions of the materials may be arranged accordingly. A description of the laying of a path for ordinary foot traffic, and modifications required to suit other forms of traffic, will be given here.

The levels of the extreme ends of the path should be decided on, and then, if an evenly graded or level stretch of concrete is desired, boning-rods should be used as shown in Fig. 17. Three boning-rods of exactly the same length are necessary, and are used as follows: At each end of the position intended for the path, and on one edge, a peg (referred to as a " levelling-peg ") about 1 in. by 1 in. or 1 in. by 2 in., and 6 in. long, is driven into the ground until its top is at the level desired for the bottom edge of the form which is to be used (the term " form " is used here instead of " mould "). Close against each of these pegs another light peg is driven. It must be placed so as to allow the boning-rod which is tied to it to rest on top of the levelling-peg (see Fig. 17). Having tied the two end boning-rods in position, a line should be stretched between them. This will assist in the alignment of intermediate levelling-pegs.

One operator (marked " A " in Fig. 17) now takes a supply of levelling-pegs and the third boning-rod. At intervals of 6 ft. to 8 ft. along the line he drives in his levelling-pegs until they are nearly at the desired level. The boning-rod is then held on top of each peg, or beside it if it is still much too high, and a second operator (marked " B " in Fig. 17) sights along the tops of the rods, indicating the level of the peg which is being placed in position. Levelling-pegs may be placed along the opposite edge of the position of the path in the same manner; or by means of a straight-edge and level the second form can be put into position after the first is secured.

If the ground on which the path is to be laid has been well consolidated by traffic and does not consist of clay an ordinary footpath can be laid directly on top of it, and 3 in. thickness of concrete will be ample,

with a slightly greater thickness at the edges of the path. Clay contracts and expands considerably, and if the ground is of this formation, or has not been well consolidated previously, a layer of porous material such as rough shingle, about 3 in. to 4 in. thick, should be laid down and well rammed. This is particularly necessary where the soil is likely to be damp and subject to severe frosts.

The levelling-pegs having been placed in position, the next operation will be to excavate to the level of the tops of the pegs, or to 3 in. or 4 in. below their tops if a foundation layer of shingle is being used. The ground or foundation layer, as the case may be, is then well rammed, and the forms placed in position and held firmly by retaining-stakes as shown in Fig. 18.

The depth of the forms should be equal to the thickness of concrete used, and for this class of work insignis pine (*Pinus radiata*), 1½ in. thick, is a cheap and suitable timber. If forms of a thickness less than 1½ in. are used it is very difficult to get a perfectly straight edge, and anything but a straight edge is objectionable to one who likes neat work. (If a curved edge is desired 1 in. or ¾ in. timber may be used, with saw-cuts at close intervals on the concave side of the form and passing almost through it, which permits of easy bending of the timber. For such work as this a more stringy timber, such as V.D.L. (stringybark), should be used, care being taken to put the retaining-stakes fairly close together.)

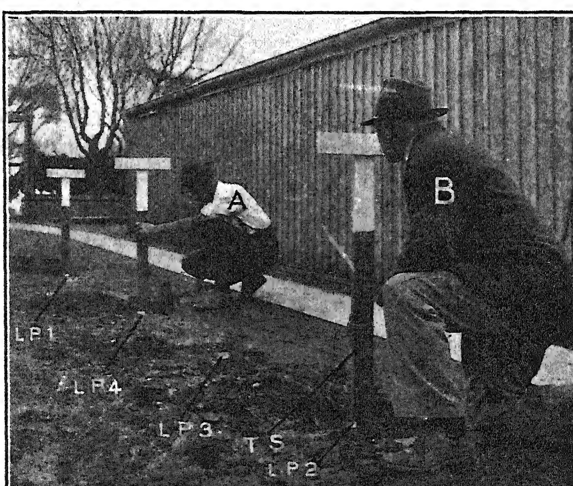


FIG. 17. SHOWING USE OF BONING-RODS IN CONSTRUCTION OF CONCRETE PATH.

The rods are here shown in use over a comparatively short distance. It is not desirable or necessary to use such rods for grading lengths of less than 20 ft., as a straight-edge or line would serve quite well for such short distances. For purposes of illustrating this work it was necessary to keep the rods close together. LP1 and LP2 are the end levelling-pegs on which the end boning-rods are resting. LP3 is a levelling-peg already in position, and LP4 is being adjusted. TS is a light stake placed in the ground temporarily for the purpose of holding the boning-rod, which is tied to it, in position. A line stretched between the end pegs assists in correct alignment of the intermediate levelling-pegs.

[*Photo by F. E. Ward.*

The next operation will be to make provision for expansion-joints. These should be put in not more than 6 ft. apart, and the work may be done by one of two convenient methods. One method is to lay the path in alternate sections, the intervening spaces being filled in after removal of the cross-forms (one of which is represented by a narrow strip in Fig. 19), which may be of the same dimensions as the side forms. When these are removed, laths, $\frac{1}{8}$ in. to $\frac{1}{4}$ in. thick, may be put along the exposed edge, or thick tarred paper used, and the blank sections between those already laid filled in. The second method, and one involving less trouble, is to put the thin laths in position, holding them at the

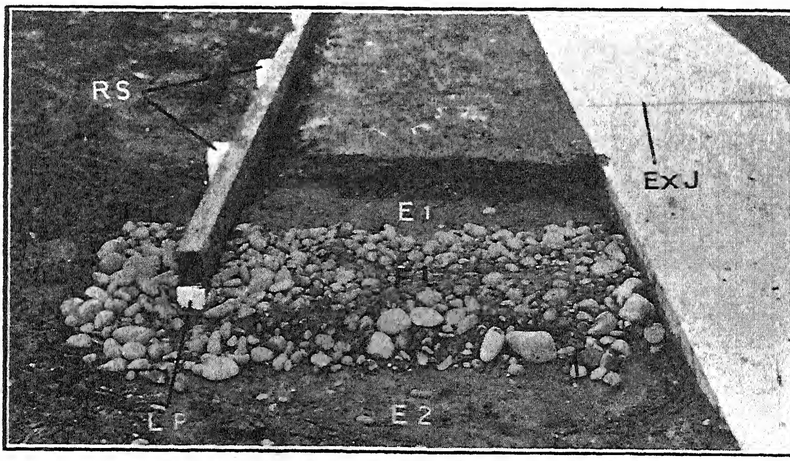


FIG. 18. SHOWING PATH IN COURSE OF PREPARATION.

One side is bounded by a form which rests on levelling-pegs, one of which is seen at LP. The other side is bounded by a strip of concrete already laid. This may be regarded as the other side form, its surface being level with top of form on left. RS are 3 in. × $1\frac{1}{2}$ in. retaining-stakes. EI is a portion excavated to a depth of 3 in., as would be the case if no foundation layer was being used. E2 represents an excavation of 6 in. in depth, with FL a foundation layer of well-rammed shingle on portion of excavated area. ExJ shows an expansion-joint in the concrete path already laid.

[*Photo by F. E. Ward.*

ends by a nail—not driven right home—through the side forms. Light temporary pegs (T.P. in Fig. 19) can be put in to assist in taking the pressure of the concrete from the side against the section being laid; or, if when a section is nearly completed a quantity of concrete is put in the next section against the lath, no danger of its displacement will be experienced. Expansion-joints formed in the manner described are very necessary, for, unless concrete is well reinforced, visible cracks are inevitable, and the use of such joints breaks the work up into sections, each of which can expand or contract without cracking. Such sections should not be more than 6 ft. along any side.

The laying of the concrete should be accompanied by good ramming, and if a very smooth surface is not desired a satisfactory finish will be obtained by levelling across the path by means of a straight-edge which rests on the side forms (see Fig. 19). A side-to-side motion, accompanied by a forward one, of such a straight-edge will leave a fairly good surface when the customary aggregate of shingle is used. Should a finely finished surface be desired, the concrete laid down first should come only to within about ¼ in. of the tops of the forms and should not be smoothed off. While the concrete is still green (within twenty-four hours of laying) a finishing-coat of one part cement to two

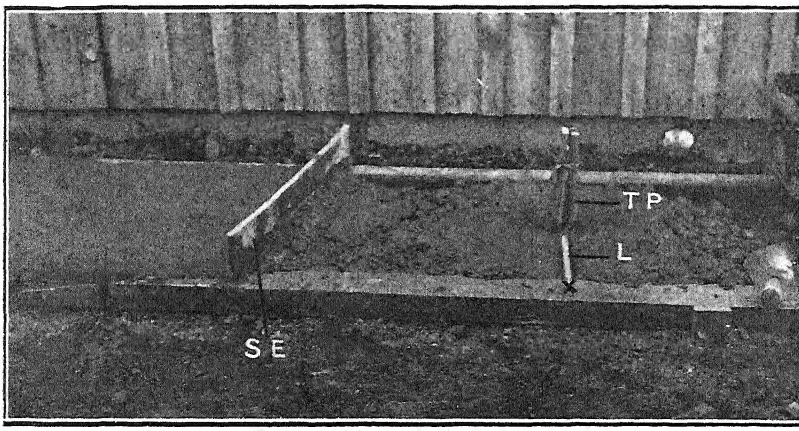


FIG. 19. SHOWING, ON A SMALL SCALE, METHOD OF FILLING IN OR LEVELLING OFF OF PATH OR FLOOR.

If the method of putting down the work in alternate sections is adopted a strong cross-form 1½ in. thick would take the place of the lath L, and the section on the right of the lath would then be filled in after the removal of the cross-form. By placing two or three light pegs similar to TP against the lath which is secured by a skew nail at X, and filling in carefully and evenly on both sides of the lath, all sections can be put in as the work proceeds. The temporary pegs TP are removed as soon as the concrete is evenly packed on both sides of the lath. The straight-edge SE has been used for levelling off between the forms after the concrete has been well rammed and left slightly higher than the tops of the forms.

[*Photo by F. E. Ward.*

of sand should be applied, and be finished off with a wooden float Excessive floating or trowelling, especially with a steel trowel, must be avoided, or hair-cracks will result. Pure cement is also likely to produce crazing or hair-cracks. All edges (outside and along expansion-joints) should be chamfered as soon as the finishing-coat will retain an impression.

The work must be kept damp for as long as possible, and should not be used until well hardened. In the case of footpaths two or three weeks should suffice, providing the edges are still protected; but in the case of paths for heavier traffic and floors for cowyards from one to two months should be allowed. Stable-floors require an even longer period if the risk of breaking the floor is to be avoided.

4. FLOORS.

The foregoing matter will serve as a guide to method in laying floors of farmyards and farm buildings, and the following table is given as a guide to strength of mixtures, thickness of work, &c. :—

Class of Work.	Ratio of Cement to Good Shingle Aggregate.	Minimum Thickness of Concrete.
Footpath	1 : 6	3 in.
Track for heavy-wheeled traffic..	1 : 5	6 in.
Cowyard or byre	1 : 6	4 in.
Stable-floor	1 : 5	4 in., thickening to 6 in. at position of hind feet.
Floor of pigsties and yard ..	1 : 6	3 in.

Floors of cow-sheds and stables should not be finished too smoothly, owing to the danger of injury to animals through slipping. Fluting of the surface in places where there is a liability of slipping is easily done by forming a series of impressions with the edge of a piece of scantling or with a frame such as that shown in Fig. 20.

Where a fairly large expanse of work is desired, as in the case of a cowyard or cow-byre floors, the best method is to put the work down in strips 6 ft. wide with expansion-joints every 6 ft. (the method on a small scale may be seen in Fig. 18). This will divide the area into sections each 6 ft. square. All levelling-pegs should be placed in position along lines where the edges of strips will fall. The foundation layer of shingle can then be put in each strip while the concrete in the

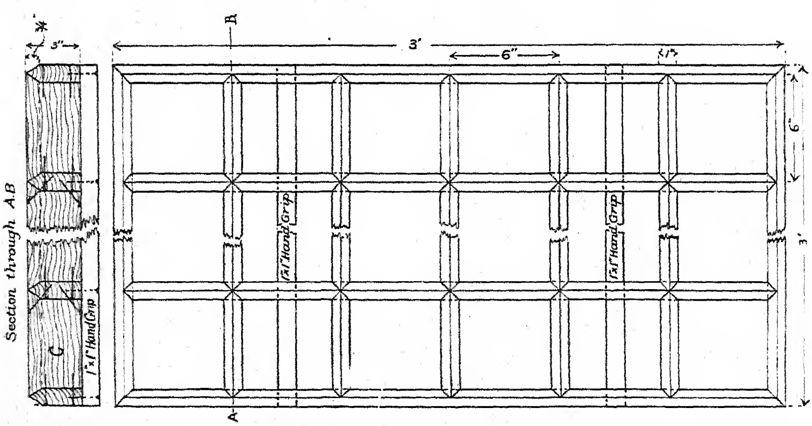


FIG. 20. IMPRESSION-FRAME FOR FLUTING COW-SHED OR STABLE-FLOORS.

Frame is made of 3 in. × 1 in. battens, and is 3 ft. square. The continuous battens provide long parallel strips, which are broken up into squares by the short cross-battens. The latter, after being bevelled, are cut to fit as shown in a typical case at C in the sectional elevation. Frame is shown inverted in plan. It should be used as soon as the concrete will keep an impression—usually half to one hour after laying in fair drying weather.

preceding one is setting. Each strip of concrete already laid will then serve as a form for one side of the succeeding strip. A thin lath or thick tarred paper against the edge of the concrete will provide the necessary expansion-joint. A fall of 1 in. in 5 ft. or 6 ft. must be allowed for.

5. TROUGHS.

PIG-FEEDING TROUGHS.

Durable pig-feeding troughs are easily and quickly made in concrete. Figs. 21 and 22 show suitable moulds for their construction. The sides of the mould (Fig. 21) must taper to allow of its easy removal.

The aggregate for such troughs should contain no stones larger than about ½ in. diameter. A good proportion of sand is necessary. The ratio of cement to aggregate should not be greater than 1 to 4. Reinforcing is essential, and should consist of a strong wire (No. 3-6) running completely round the upper edge of the trough, with chain netting or expanded metal throughout the whole of the sides, bottom, and ends. (Cyclone chain netting of No. 8 galvanized wire and 4 in. mesh now costs 1s. 11d. per square yard. Expanded metal No. 9, 3 in. across the short way of the diamond mesh, costs 2s. 6d. per square yard. The dimensions of the strands are $\frac{3}{16}$ in. by ⅛ in. Being more rigid, the expanded metal will be found more convenient to use.)

WATER-TROUGHS.

Failure to secure a watertight trough is often experienced merely because some of the simpler rules for the making of concrete are not observed. A good foundation is necessary, and to obtain this the ground on which the trough is to stand should be excavated to a depth of from 4 in. to 6 in. below the level intended for the lower side of the trough-bottom. The excavation should be at least 1 ft. wider all round than the trough, and when well rammed should be filled to the desired level with a layer of shingle also rammed until as compact as possible. The outer form (see Fig. 23) is next placed in position and well stayed to prevent bulging of the sides when the concrete is being rammed in. Reinforcing-material, the inner form, and sufficient aggregate and cement to complete the trough should now be got in readiness. The inner form, as shown in Fig. 23, should reach to within about 4 in. of the bottom edge of the outer form, and is suspended by means of the pieces of scantling across the top. These serve also as distance-pieces, and when secured to both outer and inner forms prevent bulging of the top edges. In addition to these, distance-pieces are placed between the sides of the inner form near the bottom. The sides and ends of the inner form must taper, being closer at their bottom edges than at the top. If this is not done, great difficulty in their removal and probable damage to the "green" concrete will result. Having prepared the inner form and fitted it temporarily to make sure that everything is in order, it should be removed, and the work proceeded with as follows :—

First lay about 2 in. of concrete over the whole of the foundation within the outer form. On this place chain netting or expanded metal with sufficient turned up at the sides and ends to come to within 1 in.

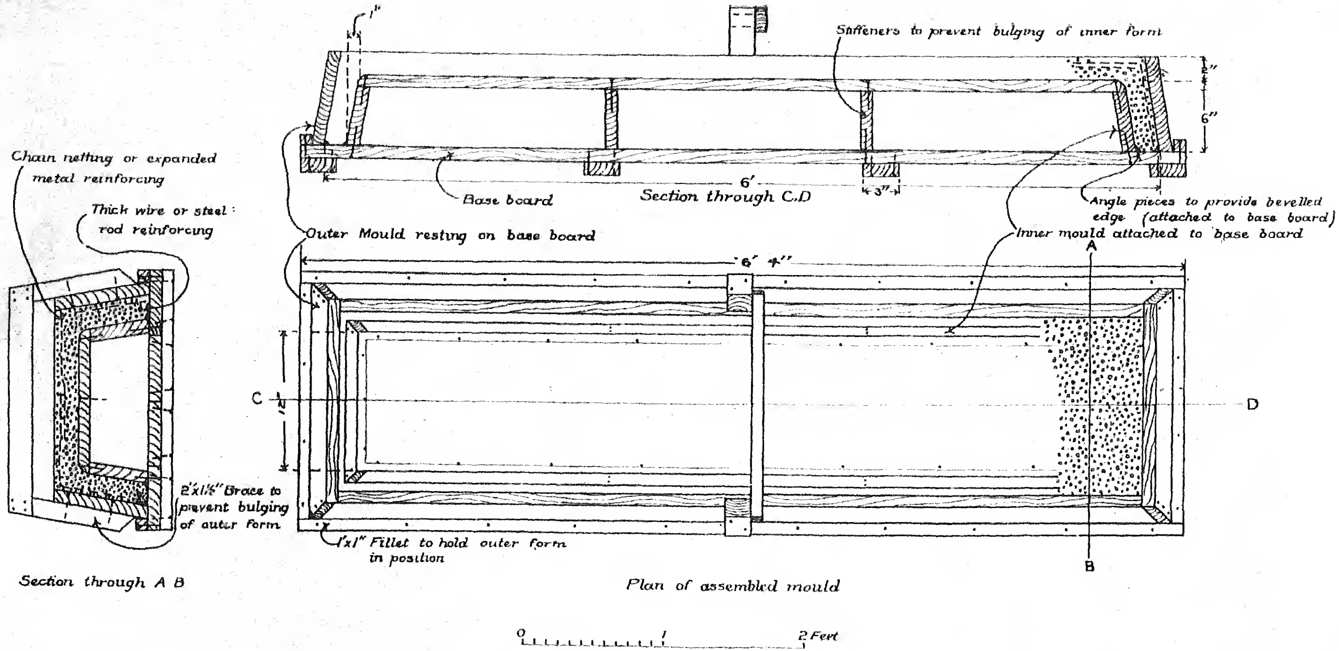


FIG. 21. DRAWINGS OF MOULD FOR PIG-FEEDING TROUGH.

Suitable for making trough 5 ft. 6 in. × 12 in. on bottom of inside, and 5 ft. 8 in. × 14 in. at top. Thickness of sides and bottom, 2 in. Outer mould rests on baseboard, and is held in position by 1 in. × 1 in. fillets running round edges. All timber 1 in. thick unless otherwise specified. In section AB reinforcing is shown to be in two pieces which overlap. Filling of sides is carried out with reinforcing in position. When filling process nearly complete (to within about 1 in. of top) reinforcing of each side is bent over and overlapped, then tied with lacing-wire.

[*Modified from "Everyday Uses of Portland Cement."*

of the top of the form, and in such a way as to ensure its being not closer than 1 in. to either form. The corners should be overlapped and fastened with lacing-wire. About another 1 in. of concrete is then placed on top of that already on the bottom, and the inner form placed in position and securely fastened to the outer form by means of cross-pieces. It should be noted here that the sides and ends of the inner form should not be too securely fastened together. The best method will be to use corner-pieces, about 2 in. by 2 in. (see Fig. 24), in which the nails are not driven right home. On withdrawal of the nails the sides and ends will be easily removed.

The filling-in of the sides may now be proceeded with. The concrete should be slightly wetter than for most purposes, and puddled rather than rammed, as a little at a time is put in. It must not be so wet as to cause water to run out of it, however. It will be found that the pressure of the material being put in at the sides causes the bottom to rise slightly. It is an advantage, therefore, to leave ½ in. or so of the bottom to be filled in when the sides are completed, when it can be levelled without danger of being disturbed again. Reinforcing-rods of ¼ in. round iron, running completely round the walls of the trough at intervals of 6 in., will give considerable additional strength, but, whether these are used or not, a rod should run completely round the top, about 1 in. below the surface. As soon as the concrete is sufficiently firm (about one hour after placing in position) the edges should be chamfered.

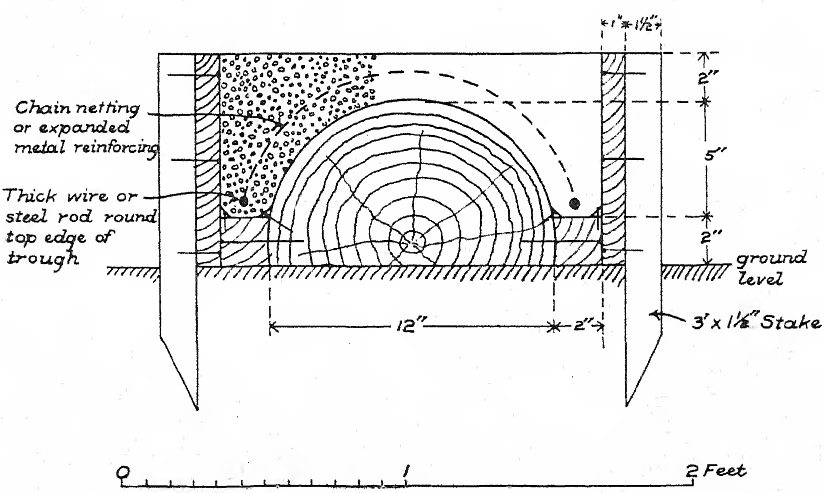


FIG. 22. SHOWING METHOD OF USING A LOG IN CONSTRUCTION OF TROUGH.

Length of trough should not be greater than 6 ft. Any excrescences must be cleaned off log, and ends so cut that length at bottom of trough (top of log) is at least 1 in. less than length at rim. If these precautions are not observed, difficulty in removal of trough will be experienced. Trough may be removed in about ten days if great care is exercised.

[*After "Everyday Uses of Portland Cement."*

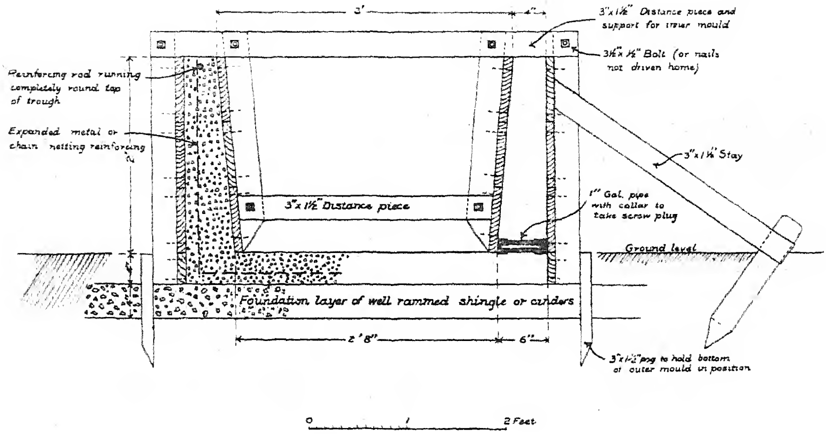


FIG. 23. CROSS-SECTION OF MOULD FOR WATER-TROUGH SUITABLE FOR CATTLE OR HORSES.

Suggested dimensions on inside of top, 8 ft. × 3 ft.; depth inside, 2 ft. Upright supports of mouldboards should be not more than 3 ft. apart. All scantling is 3 in. × 1½ in., and board 1 in. thick, except where otherwise specified.

After one or two days the inner form may be removed and the surface smoothed over with a mixture of one part of cement to two of sand. At this time the work is still "green," and a complete union will take place. If the sand for such work is passed through a fine sieve so that very small stones are removed a very thin coat can be applied with ease. The amateur will be wise to use only a wooden float for smoothing off, and to avoid its use in excess. The removal of the outer form may be carried out after two or three days, but great care must be exercised, and the work well protected and kept damp.

Provision for draining of the trough is easily made by placing a piece of pipe, with a coupling attached to take a plug or tap, at the level of the trough-floor. An alternative is to use a smooth, tapering, wooden plug, which may be driven out when the concrete is hardened.

Unless the forms for such work as this are likely to be used a number of times, a cheap timber such as insignis pine (undressed) will be quite suitable.

REPAIRING A CRACKED TROUGH.

To get a complete and satisfactory bond between old and seasoned concrete and new work is extremely difficult, and if through bad workmanship or accident a trough is found to leak the most satisfactory method of repairing the damage will be to build a new trough within the old one. In this case all that is required is an inner form, the old trough being used as the outer form. A new shell about 2 in. thick and reinforced as just described will be quite sufficient. The inside of the old work must be thoroughly cleaned and its surface roughened with a cold chisel.

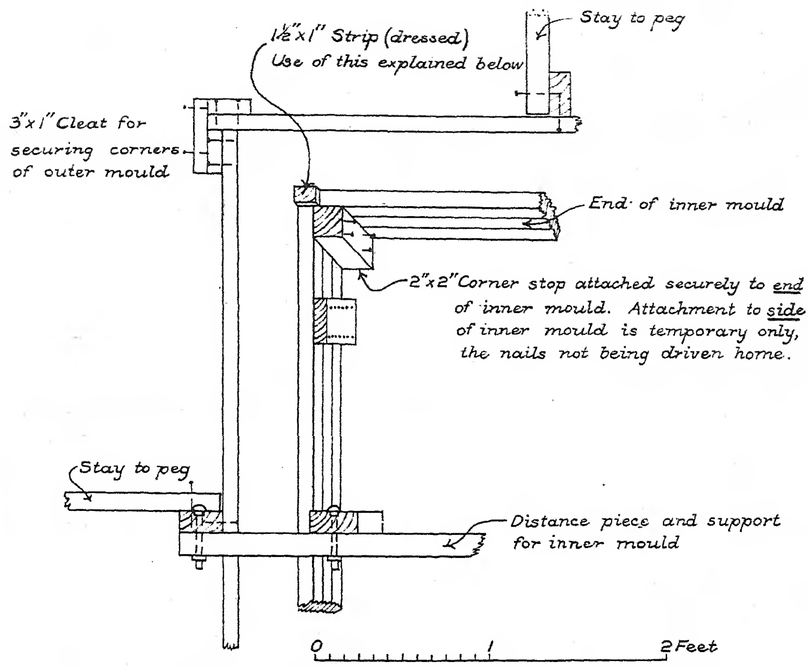


FIG. 24. DETAILS OF CORNER OF ASSEMBLED MOULD OF WATER-TROUGH.

Chief point of interest here shown is method of making provision for easy removal of inner mould. End portion is secured to side by means of nails (not driven right home) through 2 in. × 2 in. corner strip. This permits of their easy withdrawal and removal of end of inner mould. It will be noticed that end is ½ in. short of meeting side; consequently a space of 1½ in. × 1 in. is left. A carefully dressed strip, which stands sufficiently high above top of mould to allow a grip of hand being taken, is inserted in the space. It may be held in position at top by a small nail so placed as to be easily withdrawn when mould is filled. Its bottom end will be held in position by concrete as soon as filling commences. About two hours after concrete has been filled in, corner strips may be removed carefully. Result is a space between ends of sides and ends of mould and corner. Removal of inner mould about twenty-four hours later is then a simple matter, and no damage to the work need be caused.

Too much stress cannot be laid upon the necessity for keeping newly done concrete-work from exposure to frost and rapid drying. Covering with old bags, sand, or straw, well wetted in dry weather, must not be neglected.

The writer desires to express thanks for much advice and instruction in concrete-work received from Mr. R. E. Alexander, Director, and Mr. McIntosh, mechanic, of Canterbury Agricultural College. To Mr. Knight, Superintendent, and Mr Jordan, concrete expert, at Paparua Prison Farm, thanks are also due for a design of a post-mould. Mr. F. E. Ward's suggestion for the compilation of some practical directions in the simpler uses of concrete, and his valuable assistance with the camera and in affording facilities for carrying out much of the work connected with the preparation of these articles, are also much appreciated. A publication kindly forwarded by the Milburn Lime and Cement Company has proved of much use for reference. Photos of posts reproduced in the first article were taken at Lincoln College by permission of the Director.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR THE CURRENT YEAR.

L. D. FOSTER, B.Sc., Analyst, Chemistry Section, Wellington.

I. MILLING-QUALITIES.

WORK on the quality of locally grown wheats has this year been carried a stage further. A number of varieties from different localities has again been tested on the Department's experimental flour-mill, and chemical and baking tests have been carried out with the flours obtained from the different wheats. Only the milling-qualities of the different samples will be discussed in this article* ; results of chemical and baking tests will be dealt with as opportunity permits.

Of the total number of wheats received, eight samples were from the 1924 harvest ; seven of these were grown in Lake County. The eighth was an unnamed variety, probably a Durum or macaroni wheat. The remaining samples were from the 1925 harvest, and came mostly from Canterbury ; eighteen of these were grown at the Ashburton Experimental Farm, one at Cust (Rangiora County), one at Lincoln (Springs County), and the last at Hinds (Ashburton County). This sample was another unnamed variety, probably also a Durum. Three samples were received from the Gore Experimental Area (Southland).

It will be seen that most of the samples were from the Ashburton Experimental Farm. Comparatively few of the more common varieties were received, the samples being for the most part lesser-known wheats. At the same time, many of these were of considerable interest, especially the strong wheats Marquis, Red Fife, and Yeoman..

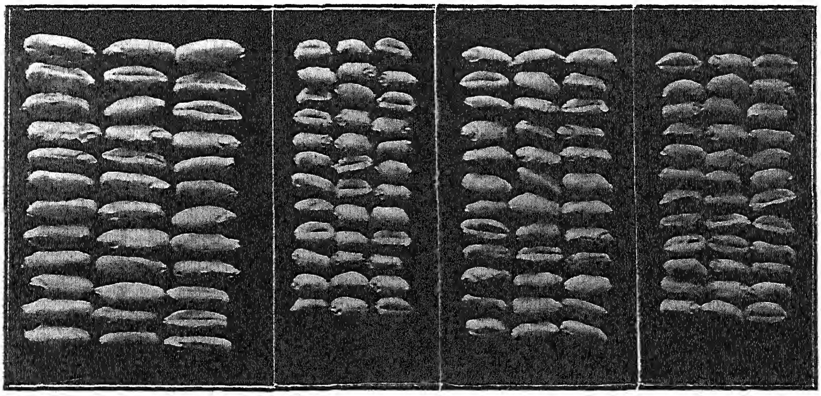
DURUM OR MACARONI WHEATS.

This year's samples include two Durum wheats, a variety more or less unknown in New Zealand, but grown extensively in certain countries, especially in Russia and Italy, and to a lesser extent in the United States and in Canada. These wheats produce flour of a kind particularly suitable for the manufacture of macaroni, &c., hence their more common name of "macaroni" wheats. Durum wheats are used for breadmaking purposes more extensively than is commonly supposed. In parts of Europe they are the most popular for this purpose, and are said to produce a loaf of excellent flavour. They are fairly easily damaged by frost, but possess great powers of resisting drought, and are highly resistant to rust and smut fungi. The chief drawback to Durums is the extremely flinty nature of their grain, and the careful conditioning which they consequently require to ensure any measure of success in milling. The flour made from them is much creamier in colour than the average. Its sugar content is generally high, and it is as a result sweeter ; it is thus useful for blending with flours deficient in this respect. Durums produce as a rule only from 66 to 69 per cent. of flour, and therefore give a rather poor yield of flour.

* The complete series will comprise : (1) Milling Tests ; (2) Chemical Analyses ; (3) Baking Tests ; (4) The Quality of Flour—(*a*) Hydration Capacity of Gluten, (*b*) Active Acidity (*p*H) of Flour.

It is uncertain if there is any demand in the Dominion for Durum wheats for the purposes of blending with the commoner varieties in flour-milling, but for the manufacture of macaroni and allied products, such as spaghetti, these wheats are unrivalled. In fact, macaroni of the best quality can be made only from Durum wheats, and it is for this purpose that the latter are grown so extensively in Italy and southern Europe. Imported macaroni of the best quality is in New Zealand an expensive article of diet (now 1s. 9d. per lb.). Since the best macaroni can be made only from Durum or macaroni wheat, it seems that the growing of this wheat locally should be of considerable importance in the manufacture of macaroni in New Zealand—that is, if it hopes to compete in quality with the article imported from abroad.

The illustration shows the remarkable size of Durum wheat when compared with some more common varieties. On the left is the sample of Durum (T 78); its length and peculiarly narrow shape



SHOWING ACTUAL SIZE OF CERTAIN OF THE TESTED WHEATS (THIRTY-SIX GRAINS IN EACH SAMPLE).

From left to right: (1.) Durum; yield of flour, 69·1 per cent. (2.) Velvet Ngapara; yield, 76·2 per cent. (3.) Solid-straw Tuscan; yield, 69·3 per cent. (4.) Hybrid W; yield, 77·3 per cent.

[*Photo by F. T. Leighton.*

are obvious, especially when compared with the sample of Velvet Ngapara (S 773) alongside it. The third wheat is Solid-straw Tuscan (T 52), and represents the average size of wheats grown in New Zealand. Hybrid W (T 101), a small wheat, is interesting because of the very high yield of flour (77·3 per cent.) obtained from this sample.

CONDITION OF SAMPLES.

This year's samples showed in some cases considerable damage from weathering. The wheats grown in Lake County were generally well filled, and never showed more than traces of damage; in texture they were fairly hard, and generally were good-looking samples. Those wheats received from Gore were also free from weathering to any marked extent. The Ashburton wheats appeared to have suffered

the most, and the samples S 765, 772, 774, 775, and 778 showed signs of being considerably affected. The uniformity and filling of some of these particular samples were consequently below the average. It should be noted, however, that others from Ashburton showed not the least sign of damage, and were in every way good-looking samples of grain.

WEIGHT PER BUSHEL.

The weight per bushel of wheat was again calculated, but no connection was found between this weight and the milling-qualities of the grain.

MILLING OF SAMPLES.

Except for the Durum wheats, which were rather difficult to mill, all the samples tested this year milled with average ease; and it is possible that with more experience of the treatment necessary for complete success Durums would also give no trouble in the mill. The actual milling of the samples was carried out with consistent results, and Table I shows the degree of agreement between those samples milled in duplicate and on different days, when the conditions regarding humidity, &c., differed to some extent.

Table 1.

Laboratory No.	Variety.	Bran.	Pollard.	Flour.
		Per Cent.	Per Cent.	Per Cent.
S 771	Velvet	11·5	14·2	74·3
		12·0	14·0	74·0
S 774	Essex Conqueror ..	11·5	13·4	75·1
		11·0	14·1	74·9
S 775	Yeoman	10·8	15·0	74·2
		10·4	15·5	74·1
T 51	Major	15·5	13·7	70·8
		14·2	15·3	70·5

The results of the milling-tests are given in Table 2. There was not a sufficient number of the better-known varieties received to warrant them being arranged as in previous years (see *Journal*, June 1924, p. 401, and July, 1923, p. 1), and the varieties are consequently not grouped together as has hitherto been the case. Varieties as a whole are divided into two parts, the first consisting of those obtained from the 1924 harvest, the second those from the 1925 harvest. They are then arranged in each part in order of the percentage of flour obtained from each sample on milling.

NOTES ON THE TABULATED RESULTS OF MILLING TESTS.

The bulk of the 1924 wheats came from the Lake district, and maintained a good average. Samples S 714, 710, and 712 produced very good, and the others good, percentages of flour. Some of these wheats were hard in texture, but all were easy to mill. A Durum wheat is included in this series, but there is a possibility that this sample was overmilled, and the percentage of flour may be misleading. In any case, the amount of flour obtained appears to be high for a wheat of this variety.

Table 2.—Milling Tests.

aboratory No.	Variety.	Where grown. Locality.	Where grown. County.	Date of Milling.	Calculated Weight per Bushel.	Milling Test. Bran.	Milling Test. Pollard.	Milling Test. Flour.	Remarks on Yield of Flour.
				1924 Wheats.	lb.	Per Cent.	Per Cent.	Per Cent.	
714..	Velvet	Ardgour ..	Vincent ..	30/3/25	63·8	13·9	11·7	74·4	Very good.
710..	Tuscan	Arrowtown ..	Lake ..	26/3/25	66·0	10·4	15·9	73·7	,,
712..	,, ...	Gibbston ..	,, ..	30/3/25	67·8	12·2	14·1	73·7	,,
709..	,, ...	Arrowtown ..	,, ..	25/3/25	66·2	15·1	12·2	72·7	Good.
708..	,, ...	Gibbston ..	,, ..	25/3/25	66·4	12·0	15·4	72·6	,,
713..	Hunter's	Tarras ..	Vincent ..	1/4/25	62·6	15·7	12·0	72·3	,,
711..	Tuscan	Arrowtown ..	Lake ..	26/3/25	66·4	18·3	10·5	71·2	Medium.
392..	Durum (?)	..	..	1/4/25	66·8	8·3	16·3	75·4	Very good.
				1925 Wheats.					
101..	Hybrid W	Horrelville ..	Eyre ..	16/6/25	65·8	11·0	11·7	77·3	Excellent.
776..	Zealand	Ashburton ..	Ashburton ..	8/5/25	69·4	11·5	11·5	77·0	,,
773..	Velvet Ngapara ..	,, ..	,, ..	6/5/25	65·4	10·9	12·9	76·2	,,
774..	Essex Conqueror ..	,, ..	,, ..	6/5/25	63·0	11·5	13·4	75·1	Very good.
771..	Velvet	,, ..	,, ..	30/4/25	67·2	11·5	14·2	74·3	,,
775..	Yeoman	,, ..	,, ..	7/5/25	63·0	10·8	15·0	74·2	,,
770..	White Tuscan ..	,, ..	,, ..	29/4/25	65·0	12·3	14·1	73·6	,,
772..	Snowdrop	,, ..	,, ..	5/5/25	61·6	13·5	13·0	73·5	,,
778..	Hybrid W	,, ..	,, ..	25/5/25	64·7	12·0	14·6	73·4	,,
75..	College Hunter's ..	,, ..	,, ..	22/6/25	67·2	14·8	11·8	73·4	,,
779..	Scandinavian ..	,, ..	,, ..	26/5/25	59·4	12·4	14·3	73·3	Good.
766..	Queen Fan	,, ..	,, ..	23/4/25	66·4	10·5	17·2	72·3	,,
76..	College Velvet ..	,, ..	,, ..	2/6/25	67·6	13·8	13·9	72·3	,,
768..	Major	,, ..	,, ..	28/4/25	65·4	12·1	15·9	72·0	,,
777..	Red Fife	,, ..	,, ..	22/5/25	67·6	14·6	13·4	72·0	,,
765..	Jumbuck	,, ..	,, ..	23/4/25	66·4	10·3	18·0	71·7	,,
767..	Queen Fair	,, ..	,, ..	24/4/25	67·2	15·5	12·8	71·7	,,
77..	Solid-straw Tuscan ..	,, ..	,, ..	4/6/25	68·0	12·0	16·3	71·7	,,
37..	Velvet	Lincoln ..	Springs ..	27/5/25	68·0	14·3	14·6	71·1	Medium.
51..	Major	Gore ..	Southland ..	28/5/25	64·7	15·5	13·7	70·8	,,
50..	Marquis	,, ..	,, ..	28/5/25	66·4	15·0	14·4	70·6	,,
769..	,, ...	Ashburton ..	Ashburton ..	29/4/25	66·8	14·0	16·0	70·0	Poor.
52..	Solid-straw Tuscan ..	Gore ..	Southland ..	29/5/25	64·4	16·2	14·5	69·3	,,
78..	Durum (?)	Hinds ..	Ashburton ..	4/6/25	65·8	8·9	22·0	69·1	,,

Of the wheats from the 1925 harvest, the best milling-wheat was a sample of Hybrid W (T 101). This sample gave the excellent amount of 77·3 per cent. flour; last year another sample of the same variety gave the very good yield of 75·6 per cent. The sample milled this year was a rather small grain (average length 5–6 mm.), but was very well filled; in texture it was soft and starchy. This variety is interesting as being a possible rival to Victor. In milling-qualities Victor and Hybrid W are very much alike, both producing on an average very good percentages of flour. This year Hybrid W gave the highest percentage of flour of any wheat received; last year and the year before Victor topped the list.

Zealand (S 776), another soft wheat, produced an excellent amount of flour (77 per cent.). This was a good-looking sample, of excellent uniformity and filling; it possessed the highest calculated weight per bushel of the samples tested this year. The next sample, Velvet Ngapara (S 773), gave the best yield of flour (76·2 per cent.) of the Velvets received; last year it held a similar position. This particular sample showed fair uniformity, was well filled, and possessed a hard and flinty texture. Essex Conqueror (S 774) produced a very good amount of flour (75·1 per cent), but in appearance was only fair, being small, of poor uniformity, and poorly filled; it had suffered considerably from weathering. This variety is of considerable interest, as will be seen in an article to follow on the baking-quality of these wheats. A sample of Velvet (S 771) was a hard, flinty wheat, producing a very good percentage of flour. Yeomen (S 775) was a fairly long grain (7–8 mm.), of medium appearance, poorly filled, and considerably weathered. It gave, however, a very good yield of flour. The following wheats call for no particular mention, except that they all gave very good percentages of flour: White Tuscan (S 770), Snowdrop (S 772), Hybrid W (S 778), College Hunter's (T 75), and Scandinavian (S 779).

The following wheats gave good average amounts of flour: Queen Fan (S 766), College Velvet (T 76), Major (S 768), Red Fife (S 777), Jumbuck (S 765), Queen Fair (S 767), and Solid-straw Tuscan (T 77).

A sample of Velvet (S 37) produced only a medium percentage of flour (71·1), an amount which is not up to the level of the average for Velvet. Two samples from Gore—Major (T 51) and Marquis (T 50)—gave medium percentages of flour. Three samples were poor in this respect—Marquis (S 769), Solid-straw Tuscan (T 52), and Durum (T 78).

VARIETIES AND LOCALITIES.

The samples from Lake County gave a good average yield of 72·5 per cent. of flour. The average for 1922 was 72·1 per cent.; the later figure is thus in agreement with the good average to be expected from this district.

Southland County wheats averaged 70·2 per cent. flour. None of the samples differed much from this figure, which is rather on the low side. Eight samples milled from the same district in 1923 gave an average of 70·7, and here again very few samples differed from the average.

The samples from the Canterbury Province gave the very good average of 73·0 per cent. flour. Those examined last year gave an average of 72·8 per cent., and in 1923 the figure was 73·2 per cent. These percentages show a very good agreement, and as a considerable number of samples from Canterbury have now been examined a certain significance may be attached to them.

So far, with the exception of Ashburton (and the samples come mostly from the Ashburton Experimental Farm), a sufficient number of wheats has not been received from Canterbury counties to enable averages for counties to be of any value.

As data on the milling and the qualities of wheat are gradually collected it should be possible to obtain significant figures not only for provinces, but for each particular county at least, and eventually for each localized wheatgrowing area.

SUMMARY AND CONCLUSION.

A sufficient number of the better-known varieties to make any useful comparison between varieties was not received this year. Five samples of Velvet averaged 73·7 per cent. flour, and fully maintained the good average characteristic of this variety. As a whole, the miscellaneous wheats gave very good milling results, Hybrid W, Zealand, and Essex Conqueror being outstanding varieties.

Of the wheatgrowing districts, Canterbury Province more than maintained its good average (73·0 per cent.) for the percentage yield of flour. The Lake district, represented by considerably fewer samples, was practically as good in this respect (72·9 per cent.). The samples from Southland were again rather low (70·2 per cent. flour).

Again no relationship between yield of flour and calculated weight per bushel could be found.

(Series to be continued.)

CANE-WILT ATTACKING BLACKBERRY.

SEVERAL reports have been received lately from various parts of Auckland Province concerning a blight observed to be attacking blackberry. The matter has been given wide publicity by the newspaper Press in relation to the question of control of the blackberry pest. Specimens of diseased plants were forwarded by Mr. H. D. M. Haszard, of Waihi. On examination at the Biological Laboratory, these were found to be infected with cane-wilt (*Leptosphaeria Coniothyrium*), a fungus common on blackberry. The fungus sometimes kills the canes back to ground-level, but usually does little more than form small cankers on the canes and spots on the leaves.

It may be mentioned that in 1921 similar reports and specimens were received by this Department from the Auckland, Poverty Bay, and Hawke's Bay districts. An investigation in the Auckland District was made by Mr. G. H. Cunningham, the Department's Mycologist, who determined the disease as cane-wilt. A full report on the matter by Mr. Cunningham was published in the *Journal* for May, 1922, under

the title of "A Fungus Disease attacking Blackberry: Identified as Raspberry Cane-wilt." The following extracts from this article are reprinted for further information :—

On the whole, blackberries are much less severely infected than are raspberries. Panicle-infection is by far the commonest stage, cane and leaf infection as a rule being slight. On canes, infection is not followed by sudden wilting, but where it has been severe, cankers appear which so weaken the cane that it gradually dies. The first appearance of the fungus on canes is made noticeable by the presence of minute white blisters. These are formed by the epidermis being separated from the tissues below on account of the dissolution of the latter by the hyphæ of the fungus. These blisters gradually increase in size and coalesce, the epidermis finally falling away, leaving minute irregular cankers in which may be seen the fruiting bodies of the fungus.

Flower and fruit infection is the common stage on blackberry, resulting in the nearly mature fruits, their pedicels, and the main axis of the panicle being killed back to the cane. Further than this the fungus rarely penetrates. This stage becomes very conspicuous where attack has been severe, as the whole panicle, including the fruits, turns a pale-chestnut colour. Infection may occur in the fruits themselves, in which case the hyphæ ramify between and send branches into the drupelets, which are soon drained of their contents. The fungus then works down the pedicel and up into other fruits, or else by attacking the lower portion of the peduncle may cause the death of most of the fruits by cutting off the water and food supplies. The fact of this organism being the cause of the death of the panicles is often obscured by the presence of numerous saprophytic fungi which make their appearance on the dead fruits. Of these the most common is a species of *Rhizopus*, which forms a dense black mould over the whole surface of the fruit.

Leaf-infection, which is slight both on raspberries and blackberries, results in minute dead areas being formed, which fall away, leaving small perforations.

It is noticeable in the field that certain varieties of blackberry are more susceptible to attack than others. For example, one of the most common varieties in the North is a small semi-prostrate profusely fruiting one; wherever this plant occurs in an infected area it is invariably badly attacked. A much less common variety is somewhat erect, large-leaved, vigorous-growing, and shy-fruiting; this plant is usually free from all traces of the fungus. Infection in all degrees of severity may be seen in the field. Observations lead one to believe that this is due to the paucity or abundance of fruits, as invariably profuse-fruiting varieties are small and stunted in their growth, and suffer much more severely than the strong-growing, vigorous, shy-fruiting varieties. . . .

Regarding the use of this fungus in the control of blackberry, when it first made its appearance on blackberries it was thought by many persons that the disease would exterminate this weed. Numbers of specimens were forwarded to this Laboratory with requests for information as to what had killed them, and whether the organism could be used as a controllant. . . . Although many hundreds of infected blackberry-plants were observed on the trip referred to, not one was seen to have been killed outright. Where infection is severe practically all fruiting is prevented by the killing of the panicles, but cane-injury is so seldom seen as to render this phase of the disease entirely negligible.

From the foregoing it would appear that although *Leptosphaeria Coniothyrium* is the cause of heavy loss in certain seasons to raspberry-growers, it causes little or no real damage to blackberry-plants, though, where infection is severe, fruiting on certain varieties may be entirely prevented. The probability therefore is that if the fungus were introduced into any locality with the object of exterminating blackberry it would do little or no damage to the latter, but would spread to a host more favourable to its development, such as raspberry, should this plant be growing in the neighbourhood. Furthermore, there is always the danger of its spreading to hosts other than the two under discussion. In America it has been recorded on roses and apples, and in Europe on a large number of hosts, among which may be mentioned barberry, elderberry, and willow.

PUWERA EXPERIMENTAL AREA.

DEVELOPMENT FROM GUM-LAND HEATH TO DAIRY FARM.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

EARLY in the present year it was decided to establish a small herd of dairy cows at Puwera. On the improved area, 66½ acres in extent, about 50 acres were in good pasture, while the remainder was ploughed and lying fallow, awaiting seeding to fodder crops on one portion and to grass on the rest. The established rye-grass - clover pasture is considered first class, and as it had carried an average of one cattle-beast to 2 acres—and the stock had done well—it was thought that dairying could be attempted with good prospects of success. The object is to ascertain what amount of butterfat per acre can be produced on the area.

A dairy shed has recently been erected, consisting of two milking-bails and a separator-room. Hand milking is now being carried on, with a herd consisting of nine heifers and five cows, all grade Jerseys. The heifers are of a good type, and the cows are fair average herd animals. A young Jersey bull, "Dominion Success," with good butterfat records on both sides of his ancestry, has been secured from the Department's stud at Ruakura Farm of Instruction. Two pedigree Berkshire sows have also been obtained from Ruakura.

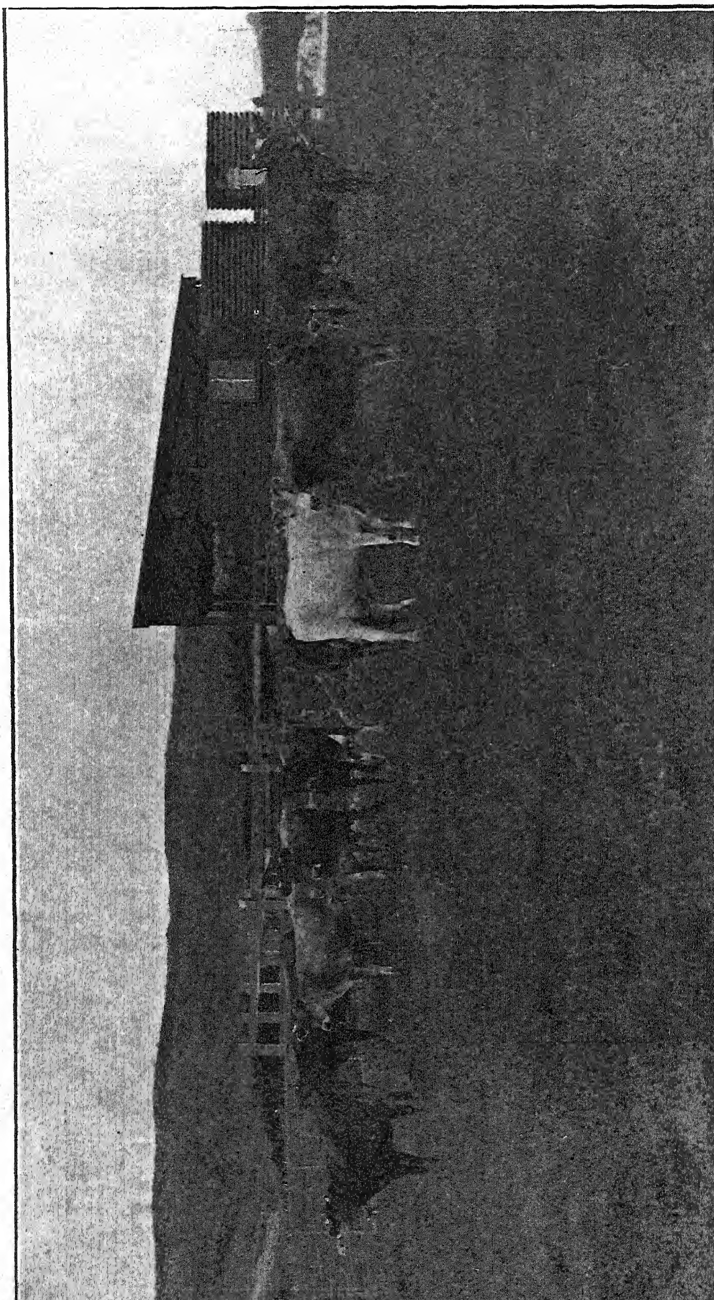
A house has been built for the manager. Altogether Puwera to-day has the appearance of making a prosperous dairy farm. The rich green of the pastures stands out in marked contrast to the surrounding virgin areas of hungry gum-land heath which stretch for miles around. Clumps of shelter-trees, mainly wattles, and also hedges, are improvements of value to the stock.

Another area of 180 acres, adjoining Puwera, was taken over from the Lands Department during the year, and it is our intention to break in to grass all but about 50 acres of this. When this is accomplished there will be a dairy farm of approximately 200 acres, on which it is expected a herd of sixty cows can be run successfully. This size of section is suitable, and should provide a living for a settler and family.

WORK OF PAST SIX YEARS.

During the past six years work at Puwera has been necessarily of an experimental nature. It has been pursued with two main objects: to treat the intractable stiff clay so as (1) to be able to establish a useful pasture on it, and (2) to be able to grow fodder crops successfully so that feed could be provided for stock all the year round, especially when the production from the pastures proved inadequate.

Both the objects have now been accomplished. The results achieved have been better than was anticipated. Pastures with a carrying-capacity of the equivalent of a cattle-beast to 2 acres have been established and maintained. The pastures show improvement from year to year. Ordinary stock- and pasture-management methods which are within reach of every farmer have been followed in accomplishing this. A list of suitable fodder crops grown successfully on Puwera is



PART OF THE DAIRY HERD AND THE MILKING-SHED AT PUWERA EXPERIMENTAL AREA.

now in our possession. This list includes crops which will provide feed when the pastures are more or less dormant in the winter, and others which give feed when the grass is usually dry in the late summer and autumn.

To reach to the point in gum-land development that we have attained to-day needed, of course, a good deal of experimental work in soil-treatment, including liming and manuring, grass-seed mixtures, crops, and variety trials. Many of the experiments gave negative results; others gave only partial results. It will be realized that any attempt to get at costs, and to place the whole work thus accomplished on a commercial basis, from the data supplied by the experiments carried out, cannot be accepted with certainty.

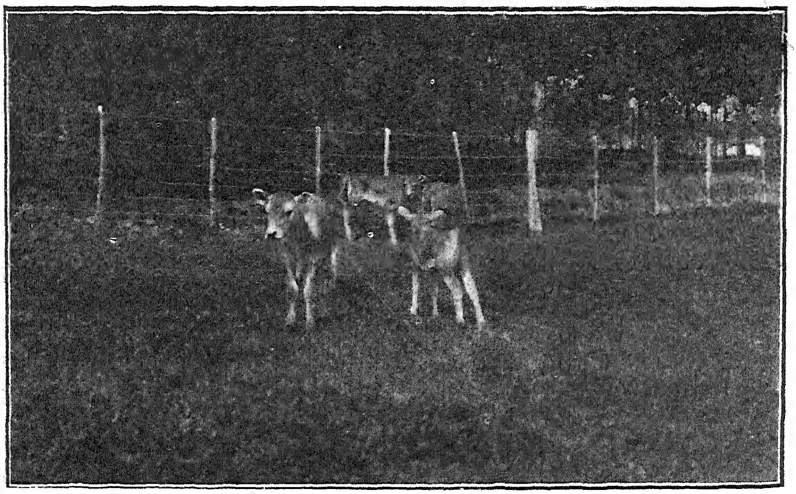
COST OF GUM-LAND DEVELOPMENT AND PASTURE-ESTABLISHMENT.

The matter of costs is a question of paramount importance. It is the problem to which the work on the new area at Puwera is now being directed. The breaking-in of the land is narrowed down, by reason of the previous six years' work, to clear-cut lines of soil preparation, manuring, seed mixtures for pastures, and treatment for other crops. Therefore the calculation of costs from the operations now in progress, and which have already been demonstrated as successful, will be a simple matter when the work is completed. About 50 acres of the area are ploughed, and it is intended to sow this portion in grass next autumn. Another 50 (probably 80) acres will be cultivated and sown in the autumn of 1927. By that time a sufficient area will be grassed to allow of a definite cost per acre being assigned to the breaking-in of the land. The methods used on the improved area are practicable. If they are proved to be profitable also (the writer feels confident they are), then the gum-lands of the heavier types can be used for profitable dairying.

Although it will be some time before a reliable statement can be made as to the cost of establishing pasture on gum-lands at Puwera, an estimate—which may later prove to be near the mark—can be given tentatively. At local-contract prices for the various operations, allowing for one ploughing, the necessary diskings and other cultivation, the grass-seed mixture, and manure and lime, £7 an acre will be sufficient. A second ploughing is certainly advisable; therefore another £2 must be allowed for that. Add £3 for fencing, and, with top-dressing and other costs, about £15 per acre would probably be a safe figure to cover the cost of establishment of pasture fit to carry dairy cows. If this figure be accepted, then the outlay to improve land to the level of production at Puwera—that is, 3 acres to a dairy cow—would be £45. This would enable settlers to follow dairying profitably on gum-land. If £20 an acre were allowed to break in the land, only £60 worth of land would be required to run a dairy cow. It will be seen that, basing land-values on present New Zealand standards, these costs would safely allow dairying to be carried on profitably. The cost of maintaining the pastures and providing necessary fodder in addition is not higher than in districts where dairying is intensive.

The chief difficulty for the utilization of these lands for farming is clearly one of finance. Looked at from the viewpoint of the individual prospective settler, this difficulty is very real. He would require too

much initial capital to face the work unaided. On the lower figure allowed for breaking in the land, he would require from £1,500 to £2,000 to break in a sufficient area for running a herd which would support him. Obviously, therefore, it would be more a matter for the State or for private enterprise on a considerable scale to bring the land into profit, when settlers could take it up and make a living off it. No doubt, for this reason, individual farmers seeking land, and having sufficient capital to tackle gum-land, will turn their attention for some time to come to improved areas where returns are more immediate.



IN THE CALF-PADDOCK AT PUWERA.
Showing a good sole of rye-grass and clover, and good shelter.

LAST SEASON'S OPERATIONS.

The main work at Puwera during the season of 1924-25, other than the seasonal operations on the improved area, was the cutting of manuka and filling-in of gum-holes on the 16 acres of land on the flat and on the northern side of the creek in Field 7. The manuka was about 10 ft. to 12 ft. high, and very dense. The soil on this portion of Puwera is the best quality on the farm. The portion of this area off the flat, and comprising the bulk of 16 acres now lying fallow, will be put into grass pasture in the coming autumn. The flat has been used for fodder crops for cattle and horses. A good crop of oats was taken off it last summer.

Pasture-management.

The pastures were top-dressed in June with basic slag at the rate of 3 cwt. per acre. The striking response of the pastures to slag is an outstanding feature of the work at Puwera. During the winter good growth was maintained, and, though the winter and late spring

were generally unfavourable, the pastures on Puwera came away early. Comparing them with pastures on the volcanic and other superior soils, the Puwera pastures were distinctly better. This is manifestly due in a large measure to the good effects brought about by regular top-dressing with a phosphatic manure best suited to the local conditions. The pastures are regularly harrowed with the tripod-chain harrows. This spreads the dung, and gives surface cultivation. The one evenly distributes the organic matter, so deficient in the virgin gum-land soil, while the other stimulates grass and clover growth by the surface stirring of the soil.

The fields at Puwera average from 10 to 12 acres in area. This is found to be a desirable size for getting good results from stocking. The small size of the fields allows of frequent resting in turn for short periods. This matter in pasture and stock management should certainly be given more attention by dairy-farmers than is generally the case in this Province.

Supplementary Forage.

Meadow hay was cut from 4 acres, and yielded about 10 tons of material. Oaten sheaves were also saved for horse-feed, yielding 9 tons. A surplus of both remained after the season's requirements were satisfied.

An area of 2½ acres in Field 7 was sown to mangolds, in wide drills, using the following varieties at the rate of 6 lb. of seed per acre: Mammoth Long Red, Jersey Queen, Golden Tankard, and Yellow Globe. The fertilizer mixture used was: Superphosphate, 3 cwt.; bone-dust, 1 cwt.; blood-and-bone, ½ cwt.; kainit, 1 cwt.; total, 5½ cwt. per acre. The yield over the area was estimated at 25 tons per acre.

One acre was sown in Garton's Superlative swede, at the rate of 10 oz. seed per acre; 2 cwt. of super mixed with 1 cwt. of bonedust per acre was applied with the seed. A crop was taken yielding about 15 tons of roots.

An area of ¾ acre was sown in maize, pumpkins, and marrows. Pukeko destroyed the whole of the maize; each season these birds are becoming more troublesome. The pumpkins and marrows gave a yield of 2 tons 5 cwt. 20 lb.

At the end of the season we had 3 tons of roots unused on hand, and these were sold to local farmers. After the dairy cows were put on the green oats, late in August, they would not eat the mangolds, swedes, nor hay.

INSTRUCTION TO FARMERS.

During the sessions of the winter farm-school held at Whangarei in May last an afternoon was devoted to Puwera. There were 120 farmers present, and they were shown over the Area. A total of about 350 farmers visited Puwera during the year. Right throughout North Auckland farmers are showing increasing interest in the work at the Area, and these visits prove helpful in providing general information from what is seen concerning farming.

WEATHER CONDITIONS IN 1924–25.

During the season under review the spring was favourable, with good rains. Grass-growth was therefore satisfactory. A dry spell set in in January, and the weather continued fairly dry until late in April. The winter proved favourable until towards the end. The spring was late, but the pastures came away well in September, and have done well since. The total rainfall was 49·76 in., and there were 164 days on which rain fell. The mean annual rainfall for Whangarei during the past thirteen years is 51·47 in.

EXPERIMENTS ON MANURING OF RAPE IN CANTERBURY.

F E. WARD, H.D.A., Instructor in Agriculture, and A. W. HUDSON, B.Agr., B.Sc., Assistant Instructor in Agriculture, Christchurch.

IN the 1924–25 season three experiments on the manuring of rape were conducted in the Darfield district. The following manures were used: (1) Superphosphate, 42/44, 1½ cwt. per acre; (2) Ephos basic phosphate (containing about 62 per cent. of phosphate expressed as tricalcic), 1½ cwt. per acre; (3) a mixture of super and Ephos in equal parts by weight, 1½ cwt. per acre; (4) a mixture of 1½ parts of super to 1 of dried blood, 2½ cwt. per acre. Unmanured control plots were sown, but owing to the almost entire lack of growth on them weights were not taken.

METHOD OF SOWING.

As in the case of experiments in manuring of wheat (*Journal*, April, 1925), the adjustment of the drill to give the desired quantity was determined before the plots were sown. Each plot was one width of the drill, and each treatment was sown in quadruplicate, except in one case where sowings were triplicated, rain interfering before the fourth series could be sown.

The rape on areas ½ chain by a definite number of coulter-widths was cut at ground-level with sharp spades and weighed immediately. From three to eleven such areas were cut from each plot, according to whether the soil-variation was relatively great or small. There were therefore twelve to thirty-three plots weighed in each treatment. The differences in yield and degree of reliance attachable to such differences have been calculated from pairs of plots. The most centrally placed plot is used as the standard, and each area in it is compared with an adjacent area of another treatment, or with one separated only by one intervening plot.

EXPERIMENT I: ON FARM OF R. S. GUNN, RACECOURSE HILL.

This experiment was carried out in a paddock which had been in grass for six years. The seeding was 4½ lb. per acre, in 7 in. rows. The plots were sown on 24th November, 1924, and weighed just over eight weeks later, on 21st January, 1925. A month after sowing, all plots which received super alone or mixed with Ephos or blood were

equally good, and superior to those having Ephos alone. On 6th January, six weeks after sowing, the Ephos plots were still lagging behind, and the super-and-blood plots were superior to any. The accompanying photograph shows the plots at this stage. The Ephos plots

A TYPICAL PORTION OF THE EXPERIMENT, ON MR. GUNN'S FARM SIX WEEKS AFTER SOWING.

The control plots, almost bare of growth, are seen in the background on both sides. Between the controls the order of plots, from right to left, is (1) super-and-blood treatment, (2) super, (3) Ephos, (4) super and Ephos.

appeared to be ripening off, although at the time of cutting they were less ripe than the super and super-and-Ephos plots, as also were the super-and-blood plots. The results of the weighings are shown in the following table:—

Table 1.

(Area of plot weighed, $\frac{1}{377}$ acre.)

Treatment other than Super.	Number of Paired Plots.	Tons per Acre.		Differences*: + In Favour of Super. − In Favour of other Manure.	Odds in Favour of Difference being Significant.
		Yield of Treatment other than Super.	Yield of Super.		
Ephos	12	4·78	7·05	+ 2·27	>9,999
Super and Ephos ..	12	6·76	7·05	..	11
Super and blood ..	12	8·08	7·05	−1·03	>9,999

* Where the odds are less than 30 to 1 in favour of a difference being significant such difference is not regarded as being due to the treatment, but to chance variation, and is not shown in the "Difference" column.

EXPERIMENT 2: ON FARM OF J. SYMES, DARFIELD.

The plots were sown on 29th October, 1924, on a paddock which had been in grass for four years, and weighed on 19th January, 1925, twelve weeks after sowing. The seeding was at the rate of $2\frac{3}{4}$ lb. per acre, in 7 in. rows. The crop was inspected on 25th November, when all plots receiving some super were equally good, and much better than the Ephos treatment. When the weighing was done the super and super-and-Ephos plots were slightly riper than the Ephos and super-and-blood plots, which were at about the same stage of ripening. It was estimated that the controls (unmanured plots), which in this experiment were better than in the other two cases, had about a quarter the crop of that on the manured plots. The following table shows the results of weighings:—

Table 2.

(Area of plot weighed, $\frac{1}{566}$ acre.)

Treatment other than Super.	Number of Paired Plots.	Tons per Acre.		Differences: + In Favour of Super. − In Favour of other Treatment.	Odds in Favour of Difference being Significant.
		Yield of Treatment other than Super.	Yield of Super.		
Ephos	33	9·08	9·21	..	0·5
Super and Ephos ..	33	9·18	9·21	..	..
Super and blood ..	33	11·11	9·21	−1·90	>24,000

EXPERIMENT 3: ON FARM OF W. W. MULHOLLAND, DARFIELD.

The rape crop in this case followed two seasons of wheat preceded by a fallow after grass. The plots were sown on 10th October, 1924, and weighed on 10th January, 1925, having had a growing-period of thirteen weeks. The seeding was at the rate of $1\frac{1}{8}$ lb. per acre, the sowing of seed and manure being done in 14 in. rows.

In this experiment some difficulty in getting correct adjustment of the drill was experienced, and the actual quantities of the several manures sown were as follows: (1) Super, 148 lb.; (2) Ephos phosphate, 138 lb.; (3) super and Ephos, 143 lb.; (4) super and dried blood, 300 lb.

Table 3.

(Area of plot weighed, $\frac{1}{377}$ acre.)

Comparison: A *versus* B.	Number of Paired Plots.	Tons per Acre.		Difference in Favour of A.	Odds in Favour of Difference being Significant.
		Yield of A.	Yield of B.		
A, Ephos; B, super	12	5·39	5·01	0·38	63
A, Ephos; B, super and Ephos	16	5·20	5·07	..	7
A, super and blood; B, super	12	5·78	5·01	0·77	1,666

Six weeks after sowing, the super-and-blood plots showed the greatest growth, with super and super-and-Ephos slightly superior to the Ephos alone. At the time of cutting and weighing, the super-and-blood plot was still superior, but no difference between the other manured plots could be distinguished. The yields are given in Table 3, the super and super-and-Ephos being compared with Ephos alone, and super-and-blood compared with super.

CONCLUSIONS.

(1.) The addition of 1 cwt. of dried blood to the super has caused an increase in yield in every case. Owing to the difficulty of placing a value on the rape crop it is not certain to what extent this increase pays, and no definite conclusion will be drawn until further trial has been given and data regarding the return from the rape crop collected.

(2.) In all cases the super-and-Ephos mixture has yielded as well as super alone. (In 1924 super, 42/44, cost £7 5s., and Ephos £6 15s., per ton. The mixture costs 5s. per ton less than the straight-out super. Hence it does not appear that there would be any great advantages to be gained by mixing.)

(3.) Table 1 shows that the super plots are markedly superior to the Ephos plots after eight weeks of growth. As the growing-period is extended the advantage is less marked, and in Table 3 the Ephos has a slight advantage over the super. However, the fact that the rows were wider apart in this instance renders a strict comparison and conclusion unwise.

(4.) Ripening is delayed by the Ephos as compared with super, and by the addition of blood to super.

We are greatly indebted to Messrs. Gunn, Symes, and Mulholland for assistance in carrying out the work on their respective farms. The experiments are being repeated in the present season.

FAULTY CREAM DUE TO STAGNANT WATER.

THE following extract from a report by Mr. W. G. Batt, Farm Dairy Instructor to the Kaitieke Co-operative Dairy Company, may be of interest to cream-suppliers and to dairy companies generally which are endeavouring to improve the quality of their produce :—

"An unusual case of inferior cream came under my notice at the end of September at the Piriaka Factory. A supplier, whose farm is fairly close to the factory, had been supplying superfine cream grading 93 points, and which suddenly fell to second grade—87 points. The manager referred to this cream as "very unclean," and suggested that conditions on the farm were possibly not all that could be desired. Knowing, however, that the farmer concerned was scrupulously clean and had up-to-date appointments, I hardly credited the idea, and found, upon investigation, that the trouble was due to bacterial contamination from stagnant water. During the period of superfine grade cream the herd had been on high country, but had then been moved to levels that were very wet and had a prolific growth of water-grass in much of the stagnating water. In eating quantities of this grass the cows consumed

a considerable amount of the roots, which were well saturated and had a strong odour. Next day I took out and installed a cooler at the farm, and when the cream next arrived at the factory it was regarded as superfine. A quantity, however, was held over for examination and kept under normal temperature for about twelve hours. Examination after that time showed that it had deteriorated to a remarkable extent, having a strong odour and very unpleasant taste—a cream decidedly second grade. It was apparent that the cooler had retarded the development of the bacteria causing the trouble while the cream was on the farm, and sufficiently long for it to arrive at the factory in good condition. Immediately it left the farm, however, and probably with a slight rise in temperature, the bacteria had quickly turned the cream into an article of very inferior quality.

"Time did not permit of a curd test being made of this particular milk, but no doubt it was a case in which the curd test or other simple means of the sort would be a decided help to cream-graders."

—*Dairy Division.*

PESTS IN IMPORTED BULBS.

PACKING AND TRANSIT TESTS INITIATED.

THE unsatisfactory state in which bulbs from the United Kingdom and the Continent of Europe have been coming to hand for some time past has been the cause of dissatisfaction not only to New Zealand importers, but to those in other parts of the world, including the Australian States and Canada. The matter has recently been the subject of correspondence between the New Zealand Department of Agriculture and the High Commissioner and the Ministry of Agriculture in London, with a view to devising a more satisfactory state of affairs, if possible.

Prior to his departure for England in January last, Mr. T. W. Attwood, of the New Zealand Fruitgrowers' Federation, was commissioned to go into the matter with the authorities, and was provided with full information on the subject, together with specimens of affected bulbs. Later Mr. J. G. Myers, of the Department's Biological Laboratory, who was attending the Entomological Conference in London, joined in the investigations.

Eelworm and bulb-mite are the main causes of damage to bulbs. The mite increases rapidly on dead and decaying bulbs, and the position is generally aggravated by humid conditions in the packages, largely due to faulty packing and to unsuitable stowage in transit.

The whole position having been thoroughly gone into in London, it was decided to institute packing, carriage, and stowage tests, and in pursuance of this decision officers of the British Ministry of Agriculture made the necessary arrangements. A consignment of bulbs, representing the first of a series of tests, was forwarded by the s.s. "Corinthic," which arrived at Wellington on 22nd October. Through the co-operation of the Shaw, Savill, and Albion Company, the packages were carried at varying temperatures, ranging from 40° to 80° F.

Nothing that would indicate a solution of the difficulties was gained from this shipment, as the whole of the bulbs arrived in excellent condition. Even duplicate sets that were artificially infected with bulb-mite and forwarded at the same time, also those forming part of the experimental sets transmitted by ordinary parcel-post, showed no sign of the mites having developed, or other deterioration. The experiments will be continued, however, and it is hoped that later shipments will provide more useful information.

—*Horticulture Division.*

AGRICULTURAL EDUCATION IN NEW ZEALAND.

REPORT OF THE BOARD OF AGRICULTURE.

(Concluded from October Issue.)

THE remaining portion of the Board's report deals with matters directly related to agricultural education on which the Board desires to express its opinions, although these matters were not explicitly included in the order of reference.

1. TRAVELLING SCHOLARSHIPS.

In regard to post-graduate training in agriculture, the Board, besides recommending that provision should be made at one or more of the University Colleges for the training of research students in connection with agriculture, also recommends that the Government should provide for one agricultural travelling scholarship each year, tenable for two years, to enable post-graduate students to travel abroad in order to obtain further education in agricultural science.

2. ENDOWMENTS.

The value of endowments of land was brought forcibly before the Board on several occasions. For example, the Wesleyan Church in Auckland has been able to purchase a farm of 700 acres of land, to spend £23,000 on buildings, and to start a very successful and well-managed farm boarding-school thirty miles out of Auckland, on an endowment which was originally of little value, but is now worth some £250,000. In fifty years' time there will certainly be Agricultural Colleges attached to all the Universities in New Zealand, and if 100,000 acres of land of little present value, such as the Hautu Block in the centre of the North Island, were set aside as an endowment for agricultural education, the examples we have before us warrant the expectation that the income from such lands would ultimately go far towards meeting the expenses and upkeep of the Agricultural Colleges. Lincoln College itself is the result of the far-sighted policy adopted by the public men of Canterbury when under the Provincial Government they set aside lands to provide the wherewithal for an Agricultural College.

3. AGRICULTURAL EXTENSION WORK.

The evidence showed that when the instructors under the Department of Agriculture were able to get into close touch with the farmer and to gain his confidence the demand for instruction was insistent, and the instructors were unable to cover the large districts allotted to them. Many witnesses testified to the value of short winter courses conducted at State farms or other centres by the trained officers of the Department, and to the excellent use which is made of the winter short course in various branches of agriculture in other countries, such as the United Kingdom, Denmark, Holland, Canada, and the United States of America. The Board therefore recommends that provision should be made at suitable centres, including Farm Training Colleges, for winter short courses, to give an opportunity to farmers to further their education, and that the number of instructors in agriculture be increased in both Islands, provided that new appointees should have taken the B.Sc. or B.Ag. degree.

4. BOYS' AND GIRLS' AGRICULTURAL CLUBS.

It was shown in evidence that whenever boys' and girls' clubs were properly organized they greatly helped to awaken the interest of both parents and children in agricultural education. It was clear, however, that such clubs should be organized by experts, and that if the work devolved on the instructors in agriculture it would occupy more time than they could spare from their other duties. The Board therefore recommends that the movement be encouraged, and that the Government should appoint an officer to organize the clubs. The Board also suggests that agricultural bursaries might be awarded to boys distinguishing themselves in the competitions arranged by the clubs.

5. TRAINING AND CLASSIFICATION OF TEACHERS.

During the inquiry the evidence brought before the Board tended to show that as far as the subjects of agriculture and nature-study are concerned, provision was wanting in the teachers' training colleges for the trainees to acquire a knowledge sufficient to fit them for the proper teaching of pupils in the primary schools so that nature-study should be made attractive and the children trained to make careful observations in the district around them. It is not, of course, feasible to teach agriculture in the primary schools, but practical work in nature-study can be made at least as powerful an instrument for developing and training the mind as the more academic studies, and at the same time a knowledge and love of rural life and work can be instilled into the pupils. A pupil so trained would be prepared to take full advantage of a suitable rural course in a district high or other post-primary school, and could then pass on to a Farm Training College and be able at once to take advantage of the specialized training which the college would offer.

In order to provide an appropriate course in rural science and nature-study for teachers in training colleges it would be necessary to give the training college sufficient land to allow for experimental work by the students in garden and nursery. In Dunedin the Training College has the use of municipal reserve lands adjoining the Botanical

Gardens, and a similar provision in the other centres would be of great value. The municipal authorities might well be asked to grant the use of part of the Town Belt or other reserve for the purpose, since the proposal would not involve the sacrifice of any open-air space, but on the other hand would tend to beautify them.

With a view to encouraging teachers to take up seriously the study of rural science and agriculture, the Board considers that these subjects might well be made compulsory in the courses for teachers in training, or, if this were not found practicable, the Board recommends that special weight should be given to the subject of nature-study and agriculture in the Teachers' D and C Examinations and in the training-college course for primary-school teachers, and that grading-increment be given for proficiency in agriculture and nature-study. In this recommendation the Board had in mind the practice in Holland, where, according to the evidence of Dr. Lotsy, teachers in the primary and high schools who have a special teacher's diploma in agriculture receive a special salary-increment whether they are actually teaching the subject or not.

In connection with the science work in the primary schools, and the supervision of the teaching in nature-study and rural science, the Board desires to call attention to the work of the itinerant instructors in agriculture who are employed by the several Boards of Education. These men are usually well qualified, and are doing excellent work in training both pupils and teachers, besides paying attention to the laying-out of school-gardens and helping the officers of the Department of Agriculture to control and judge the agricultural-club competitions for girls and boys. The numbers given in the preface to this report show that additional instructors must be appointed if the supervision is to be adequate. The Board is also of opinion that the short courses in rural science and agriculture arranged for the teachers by these instructors are of great value and should be encouraged, and that for this purpose the resources of the Department of Agriculture should be used to the fullest extent possible, so that the teachers may be able to get first-hand information of the results of the investigational work of the Department of Agriculture, as well as gaining some practical experience under the direction of the expert instructors in the Farm Training Colleges.

6. POST-PRIMARY SCHOOL COURSES.

At a recent meeting of the University Senate the Chancellor prominently stressed the fact that although agriculture was the greatest industry in the Dominion it was largely neglected in our schools. The Board had evidence that only about 10 per cent. of the boys in high schools take agriculture, although about 30 per cent. enter the industry after leaving school. The Board therefore made particular inquiries to find out why the subject should be so neglected. Educationists were asked whether they thought that the subject was not of sufficient educational value to be made a leading feature of the curricula of secondary schools. The replies indicated that a proper treatment of rural science and elementary agriculture in the high school would provide as fine mental training as could be had in any other way. In fact, Mr. Tate, Director of Education in Victoria, gave

evidence that in his experience, though the study of agriculture apparently retarded the progress of the boys in the general subjects in the first year, yet in the second year the agricultural students were well to the front, and this he attributed to the fact that "many of the boys dealing merely with words in English or Latin were in the habit of reading books, and that when they got into a difficulty they turned to a dictionary, and had an attitude of mind entirely different from that of boys who were facing realities and being taught to think in terms not of words, but of things." Mr. Tate strongly expressed the opinion that "the boy who is well trained in agricultural science, and who uses the practical work, either in experimental plots on the school-farm or on a big scale, is getting a training that is very hard to beat in any school subject." The same view was expressed by officers of the Education Department, and also by other educationists. It was thus clearly established that the proper treatment of agricultural science in the high schools would not only be of immense benefit to the industry, but would also form one of the most valuable factors in the general education of the pupils.

There was also ample evidence that the Department of Education and the various Boards controlling post-primary schools were sedulously trying to make agricultural science a strong subject in the curriculum by provid ng facilities for teaching the subject considerably beyond the immediate demand for instruction. There being, therefore, no natural reason for the relative neglect of the subject, the Board was forced to the conclusion that some artificial restraint was at work to prevent it from becoming popular. Such a restraint was found in the conditions of the Matriculation Examination, which at present dominates the curricula of the secondary schools. Agricultural science has only been recognized as a half-subject for the Matriculation Examination since 1916—that is to say, it may be taken as an alternative to botany or physiology in the second paper in the optional subject of natural science. The Matriculation Examination is a written examination (although certificates of having completed a practical course are required in connection with science subjects), and in consequence a a book-work subject pays better than a practical subject for the time spent in preparation.

Also, agricultural science was not included among the subjects for the degree of Bachelor of Arts until 1922, so that a pupil taking this subject for matriculation could not, until recently, take it also for the ordinary degree in arts. Hence few teachers in secondary schools have had any considerable training in agricultural science, and the natural trend has been towards more academic studies which have behind them the weight of many years of careful organization. The result is that pupils are handicapped so far as the Matriculation Examination is concerned by taking agricultural science, even if they propose to take a University course leading to the degree of Bachelor of Agriculture, and in consequence most pupils take subjects which tend rather to wean them away than to incline their hearts towards rural pursuits.

Evidence showed that the question of modifying the Matriculation Examination was being discussed by the Senate of the University, and that the Education Department and the teachers in post-primary

schools were alive to the need for reform. It is possible that some kind of accrediting system whereby the pupil might be matriculated on the recommendation of the school authorities, or other authority recognized by the University, might be adopted with advantage, so that the schools would be less tied down to a single course for pupils wishing to matriculate, and other courses of a less academic character, but of equal or superior educational value, would be able to attract their share of the keener students.

The Board wishes to express the opinion that the evidence before it shows—(i) That the courses in secondary schools are dominated mainly by the requirements of the Matriculation Examination ; (ii) that elementary agriculture and nature-study are taken by only a small proportion of the boys in post-primary schools.

The Board is strongly of opinion that the subject of elementary agriculture and nature-study should be taken by all boys as a carefully correlated extension of the work done in nature-study in the primary schools, and therefore recommends that this subject should be compulsory in the courses for the Public Service Entrance, Intermediate, and Matriculation Examinations. The Board is further of opinion that any pupil taking the agricultural course in a secondary school, district high school, or technical school should be entitled to receive a "lower leaving-certificate" in respect of such course, provided that a satisfactory standard has been reached by the pupil in English and the special subjects of the agricultural course. The Board suggests that such standard might be fixed by an Inspector of the Education Department, in consultation with the Principal of the school.

7. AGRICULTURAL HIGH SCHOOLS.

In order to cater more especially for those pupils who intend to enter on a degree or diploma course in agriculture at a University College, and to fill the gap between the primary-school work in nature-study and the professional courses in agriculture in the University, the Board recommends that in suitable centres high schools having a special section for agricultural teaching should be established, with hostels attached, and that the Principal of such a school should have a science degree (preferably B.Ag.) so as to be able to give students a suitable preparation for entering on the diploma or degree course in agriculture at the University. The evidence clearly showed that where high schools in rural centres surrounded by a large agricultural population were under the direction of suitable teachers holding science degrees, and managed by a Board of Managers in sympathy with the agricultural work, they were eminently successful. It was also noted that such success, while primarily due to the skill and enthusiasm of the teachers, was very considerably promoted by local interest and local financial support.

The Board therefore, without specifying any particular district where Agricultural High Schools should be established, thinks that the success of the whole scheme of agricultural education would be greatly furthered by the founding of such schools in places where the settlers themselves are prepared to come forward in support of the school and the teachers.

The Board further recommends, failing the adoption of a satisfactory system of accrediting students to the University, that there be instituted an agricultural preliminary examination in place of the Matriculation Examination for the degree of Bachelor of Agriculture, such examination to be the same as that of Matriculation, with the exception that an additional science subject may be taken in place of a foreign language.

SUMMARY OF RECOMMENDATIONS OF THE BOARD.

The Board recommends—

College of Agriculture :—

(1.) That one fully equipped and fully staffed residential College of Agriculture will be sufficient for many years to come, and that such an institution should not be established until a sufficient number of degree students is available, and, when established, should be placed in a central position.

(2.) That in the meantime—

(*a.*) Provision should be made for the training of degree students by erecting laboratories and class-rooms at Wallaceville in connection with Victoria College, at a cost of some £15,000, and by transferring to the same site the Biological and Chemical Laboratories of the Agriculture Department, so that they and the existing Veterinary Laboratory and the proposed Dairy Research Laboratory, together with the expert staff, should be available in connection with the instruction of students, to the mutual advantage of the students and the Department :

(*b.*) The Ruakura Farm Training College be made available for co-operation with the Auckland University College :

(*c.*) Provision be made for accommodating additional students at Lincoln College by way of laboratories, class-rooms, and hostel accommodation ; that a grant of £20,000 be made by the Government for this purpose ; also that an additional grant of £500 per annum be paid to Lincoln College to enable the plant-breeding and other experimental work to be developed.

II. *Farm Training Colleges* :—

(1.) (*a.*) That laboratory and class-room accommodation be provided at Ruakura, at a cost of about £2,100 : and

(*b.*) That Penrose Farm, near Masterton, be developed into a Farm Training College, at a cost for additional buildings of about £7,000.

(*c.*) That the provision for training of students in Farm Training Colleges be increased as students become available, either by additions to existing institutions or by the establishment of new ones.

(2.) (*a*.) That Farm Training Colleges should be under the control of a Board consisting of the Ministers of Agriculture and Education, also one representative of each of these Departments, and three members of the Board of Agriculture, including the President.

(*b*.) That the curriculum should be made as short and intensive as seasonal conditions will allow.

(*c*.) That the work should consist mainly of demonstrations on farm methods and management, class and laboratory work, including a minimum of actual farm labour on the part of the student.

(*d*.) That the main subjects dealt with should be soils, fertilizers, crops, live-stock breeding and management, farm-management, farm economics, and horticulture.

(*e*.) That the staff should consist of a College Principal, an agricultural graduate for every thirty students, a farm overseer, skilled farm-workers capable of giving instruction in their special crafts, a horticulturist, and the necessary domestic staff.

(*f*.) That 200 acres of first-class land or its equivalent would suffice for the purpose of a Farm Training College.

III. *The Smedley Estate, Hawke's Bay* :—

(*a*.) That the estate continue to be managed by the Department of Agriculture, in association with the Public Trustee.

(*b*.) That the sum of £1,300 per annum should be allocated from the income, £1,000 for twenty-five bursaries to enable Hawke's Bay boys to obtain a training in agriculture, and £300 for a scholarship or scholarships to enable a selected Hawke's Bay student or students to take a degree course in agriculture; any balance not used in any one year to revert to the trust.

(*c*.) That suitable land be procured in Hawke's Bay out of the income of the estate for a Farm Training College to be established as soon as the need of such a college in Hawke's Bay has been demonstrated, such land to be used in the meantime as a demonstration farm.

IV. *Post-graduate Training* :—

(*a*.) That research work in agricultural problems should be encouraged at one or more of the University Colleges and at research stations, such as the Cawthron Institute at Nelson, at which special facilities for post-graduates training in agricultural work should be provided.

(*b*.) That a travelling scholarship be established to enable selected post-graduate students to proceed abroad for the purpose of furthering their education in agricultural science.

V. *Endowments* :—

That considerable areas of land of little present value, such as the Hautu Block in the centre of the North Island, should be set aside, where possible, as endowments for agricultural education.

With regard to matters not explicitly included in the order of reference the Board makes the following suggestions :—

1. *Agricultural Extension Work.*—That the number of instructors in agriculture in both Islands be increased, provided that new appointees should have taken the B.Sc. or B.Ag. degree.

2. That the number of agricultural instructors engaged in advising teachers and in directing the nature-study and elementary agriculture in primary and post-primary schools should be increased.

3. *Training and Classification of Teachers* :—

(*a*.) That improved facilities be given for training teachers in nature-study and elementary agriculture.

(*b*.) That these subjects should be made compulsory in the D and C Examinations.

(*c*.) That teachers attaining to proficiency in these subjects should receive grading-increments.

(*d*.) That the training colleges should be provided with land for experimental plots and for nurseries.

4. *Boys' and Girls' Agricultural Clubs* :—

(*a*.) That the movement be encouraged, and that to this end the Government should appoint an officer to organize the clubs.

(*b*.) That agricultural bursaries should be awarded to boys distinguishing themselves in the club competitions.

5. *Post-primary School Course.*—That, in view of the comparative neglect of agriculture in the post-primary course, due to the present conditions of the Matriculation Examination,—

(*a*.) Elementary agriculture and nature-study should be made compulsory in the courses for the Public Service Entrance, Intermediate, and Matriculation Examinations.

(*b*.) That a lower leaving-certificate should be given in respect of the agricultural course in a secondary school, district high school, or technical school, provided that a satisfactory standard is attained in English and the special subjects of the agricultural course.

6. *Agricultural High Schools.*—That in order to cater more especially for those pupils who enter on a degree or diploma course in agriculture at a University College, and to fill the gap between the primary-school work in nature-study and the professional courses in agriculture in the University, Agricultural High Schools should be established wherever the settlers themselves are prepared to come forward in support of the school and the teachers.

7. *Accrediting System: Agricultural Preliminary Examination.*—That a system of accrediting students to the University should be established as soon as possible, and that in the meantime an agricultural preliminary examination should be instituted in place of the Matriculation Examination for the degree of B.Ag., such examination to be the same as that of Matriculation except that an additional science subject may be taken in place of a foreign language.

JAMES G. WILSON, President, Board of Agriculture; JAMES BEGG, G. L. MARSHALL, E. AVERILL, EWEN D. MCLENNAN, DAVID MARSHALL, WM. B. GRANT, W. D. PIKE, WM. PERRY, D. W. WESTENRA, EDWIN HALL, Members, Board of Agriculture; GEO. FOWLDS, Representative, New Zealand University Senate; W. S. LA TROBE, Representative, Education Department; C. J. REAKES, Representative, Department of Agriculture.

ADDENDUM TO REPORT.

Mr. G. L. Marshall adds the following note:—

While fully in accord with the above report as far as it goes, I am of opinion that a site for a Central College of Agriculture of University rank should be selected on the main arterial road between Auckland and Wellington, so that the necessary planting and preparation of the property can be gone on with until funds are available for the establishment of the college. The most suitable and central site would be the Marton, Feilding, or Palmerston North district. Marton is geographically more central than any other, and the railways from Taranaki, Wanganui, Auckland, Wellington, and Hawke's Bay via Palmerston all give easy access to the district. The land and climate are also very suitable for the purpose (*vide* Professor Peren's report). A slight alteration to the Agricultural College at Lincoln will serve the needs of the South Island.

Viticulture in New Zealand.—The yield from wine grapes during 1924–25 is estimated at 85,000 gallons of wine, valued at approximately £34,000. The returns from dessert grapes grown under glass are estimated at £32,000 in value for the same period.

Sheep Returns.—The total number of breeding-ewes—13,715,223 head— shown in this year's sheep returns constitutes a New Zealand record for this class. Another feature is the further recovery in Merinos, which increased to 1,005,451 head from 903,758 in 1924.

Blackleg.—The annual report of the Live-stock Division for 1924–25 states that the position as regards this disease continued to be satisfactory, and no cases were discovered outside the known areas. The inoculation of calves was continued in the Taranaki District, and was carried out on farms in the Auckland District where the presence of the disease had been confirmed, or where there were reasonable grounds for suspecting that blackleg existed. The number of calves inoculated for blackleg in the Taranaki area was 29,261—a decrease of 16,179 on the previous year's figures.

TESTING OF PUREBRED DAIRY COWS.

CERTIFICATE-OF-RECORD LIST FOR SEPTEMBER AND OCTOBER.

W. M. SINGLETON, Director of the Dairy Division.

THE accompanying list, giving particulars of the records of cows which received their certificates during the months of September and October, is strong in both number and quality of records. Many of the performances are deserving of special reference, but the list is so long that, for the most part, the figures must be left to speak for themselves, confining brief notice to a few of the more salient records.

JERSEYS.

Keston Flower, who heads the junior two-year-olds in this list, also becomes leader of her class for the Jersey breed. She is owned by Mr. G. E. Yelchich, of Waiuku, and displaces Mr. F. J. Saxby's Alfalfa Pansy (690·16 lb. butterfat). Keston Flower commenced her test at the age of 1 year 359 days, and produced 694·28 lb. butterfat from 11,472·2 lb. milk in 365 days. Her pedigree contains many names well known to those interested in the Jersey breed, and she probably gains much of her quality from Eminent's Fontaine, who appears twice on the sire's side, and from Majesty's Fox, who appears twice in the female half of the pedigree. Keston Flower was bred by Mr. C. B. Herrold, Waiuku, who bred and tested her dam, Floral Fox (C.O.R. 469·58 lb. butterfat).

Tulip's Minta May, in the same class, is a good runner-up. Her record of 660·44 lb. butterfat should be an encouraging result of a first year's testing for her owner, Mr. H. Cole, Tikorangi.

In the mature class Mr. R. R. Dean's Dianella, with 825·42 lb. butterfat, has produced more than creditably. She already had a C.O.R. for 572·92 lb. butterfat as a senior two-year-old.

FRIESIANS.

Bainfield Topsy 10th, a junior four-year-old, is shown with 863·89 lb. butterfat; she also has a junior three-year-old C.O.R. for 468·41 lb. in 221 days. She was bred by Mr. W. D. Hunt, Waikiwi, on whose farm she gained her first certificate; her second C.O.R. was won under the testing of Mr. O. A. Cadwallader, Greytown.

The mature section includes the name of Mr. T. H. Richards's Monavale Queen Bess, whose yield of 950·90 lb. butterfat certainly places her among the high producers of the breed. Her consistency and constitution are demonstrated by the fact that she already has two C.O.R.s on high productions—namely, 740·50 lb. as a junior two-year-old and 800·18 lb. as a junior three-year-old, giving her the leadership of both these classes. She is from the stud of Mr. C. C. Buckland, late of "Monavale," Cambridge, who laid the foundation for many of the Friesian breed's high producers.

Next below Monavale Queen Bess appears Coldstream Magpie Domino, whose record of 924·47 lb. butterfat is of outstanding merit. She also has a C.O.R. for 586·27 lb., gained on a test commenced at the

age of 1 year 347 days. Coldstream Magpie Domino was bred and tested by Messrs. G. A. Marchant and Sons, Cardiff, Taranaki.

It will be noted that a third 900 lb. Friesian appears in this list, Zozo 2nd of Ashlynn having yielded 905·89 lb. butterfat. This is her second C.O.R., her record in the preceding season being 555·44 lb. Zozo 2nd of Ashlynn was bred by Mr. C. A. Hopping, and gained both her C.O.R.s at the farm of her present owners, Messrs. John Court, Ltd., Auckland.

AYRSHIRES.

The list contains a new Dominion champion for the Ayrshire breed. Mr. A. Montgomerie's Glencairn Brownie has gained the leadership of the mature class, and her performance also constitutes the highest C.O.R. Ayrshire production in New Zealand. She commenced her record at the age of 8 years 360 days, and in 365 days yielded 15,579·4 lb. milk containing 728·05 lb. butterfat. This record exceeds that of Mr. A. M. Weir's Ivanhoe Fancy, the previous highest Ayrshire producer, by 14·12 lb. Congratulations are extended to Mr. Montgomerie on his success.

The class-leaders of the Ayrshire breed are gradually but surely advancing to a very creditable stage, and this should be an encouragement to breeders of purebred Ayrshires to place their favourite stock under C.O.R. test in larger numbers than formerly.

LIST OF RECORDS, SEPTEMBER AND OCTOBER, 1925.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	JERSEYS.						
Junior Two-year-old.		Yrs.	dys.	lb.		lb.	lb.
Keston Flower† ..	G. E. Yelchich, Waiuku ..	1	359	240·5	365	11,472·2	694·28
Tulip's Minta May ..	H. Cole, Tikorangi ..	2	0	240·5	344	10,617·0	660·44
Abberley Susie ..	W. T. Williams, Pukehou ..	1	349	240·5	365	11,310·8	585·24
Waipiko Combine ..	S. H. Wearing, Richmond ..	1	272	240·5	365	10,503·3	570·60
Reid Park Maple Leaf	J. H. Sherrard, Otaua ..	1	317	240·5	365	10,453·5	558·68
Rexcourt Queen ..	J. J. Goodwin, Morrinsville	2	19	242·4	365	9,864·2	519·32
Ngahiwi Lady Bountiful	W J. Freeth, Waitara ..	1	347	240·5	364	8,413·8	512·25
Marshland's Starlike†	W. J. Chynoweth, Pukeroro	1	346	240·5	365	7,874·0	497·40
Heatherlea Alsike ..	H. J. Lancaster, Levin ..	2	40	244·5	365	9,545·2	493·48
Tirvean Nursing Sister	R. W. B. Evans, Weraroa ..	1	276	240·5	365	10,118·5	491·03
Swan's Fox's Moo-o	Brakenridge and Pearson, Taupaki	1	360	240·5	335	7,713·7	483·86
Beresford Belle ..	T. Brownlee, Pukekohe ..	1	363	240·5	365	7,147·1	483·29
Vernon Silver Rose ..	G. R. and H. Hutchinson, Auckland	1	352	240·5	365	7,535·5	478·81
Vernon Primula ..	G. R. and H. Hutchinson, Auckland	2	16	242·1	365	8,742·1	473·48
Vernon Cherry Bloom	G. R. and H. Hutchinson, Auckland	1	241	240·5	365	8,114·7	472·72
Ivondale Dolly Grey	P. J. Petersen, Brixton ..	2	15	242·0	365	8,464·9	470·03
River View Lady ..	H. Doel, Taumarere ..	2	22	242·7	365	6,887·8	467·82
Earlston Lady ..	Chisholm Bros., Hunterville	1	343	240·5	365	8,455·0	467·66
Pukatea Furze Blossom	G. R. Bell, Waipuku ..	1	331	240·5	365	7,612·2	467·30
Vibrona's Princess ..	J. R. Colson, Waihou ..	2	1	240·6	363	8,028·6	463·11

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—*continued.*

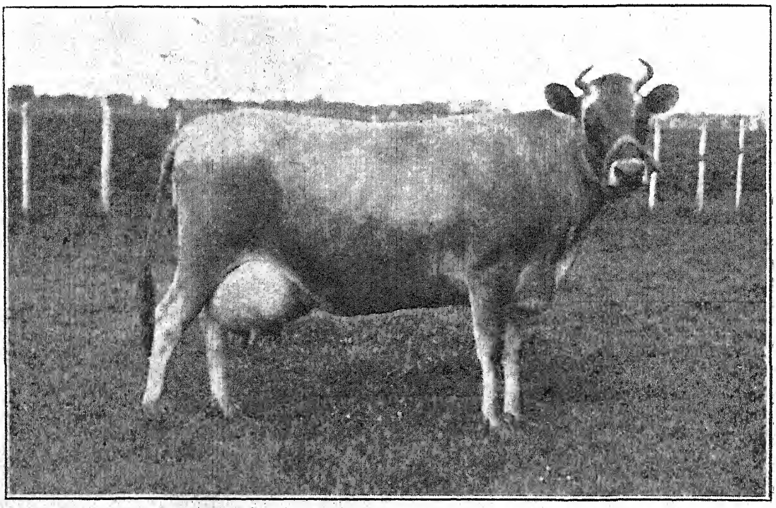
Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Double Dahlia ..	A. J. Harris, Bombay ..	1 322	240·5	346	7,440·1	460·37
Waimoeiti Jacobine ..	W. D. Dron, Spring Grove	1 313	240·5	365	7,433·3	458·71
Penrose Molly ..	J. B. Clemow, Stratford ..	1 341	240·5	365	7,950·8	456·40
Jersey Lea Zita ..	S. Bowker, Ihakara ..	1 308	240·5	365	7,502·7	451·46
Anne of Aria ..	M. V. Reeve-Smith, Aria ..	2 38	244·3	344	8,345·7	446·09
Earlston Creamy ..	Chisholm Bros., Hunterville	2 6	241·1	365	7,166·3	443·68
Gowanlea Lady ..	J. Robb, Westmere ..	2 4	240·9	365	7,872·0	441·67
Llangollen Countess†	J. T. Entwisle, Cambridge ..	2 10	241·5	365	6,379·9	436·73
Penrose Lady ..	J. B. Clemow, Stratford ..	1 324	240·5	365	7,899·8	434·06
Holly Oak Sparkle ..	F. Jennings, Mauriceville ..	1 334	240·5	365	6,791·9	430·32
Lady Ulma ..	C. G. Gibbons, Ngaere ..	1 309	240·5	365	7,998·2	429·64
Cloverlea May Morn..	D. P. F. Malone, Kaponga	1 307	240·5	336	7,486·5	429·42
Ochone Mahone† ..	C. Stevens, Maungatapere ..	1 291	240·5	365	7,994·1	428·37
Maid of Virginia ..	F. V. Green, Midhirst ..	1 360	240·5	365	7,308·1	423·54
Penrose Cyclone ..	J. B. Clemow, Stratford ..	1 348	240·5	365	7,967·2	421·58
Silken Hose ..	B. N. and W. A. Sandilands, Feilding	2 18	242·3	365	8,039·9	420·63
Beechlands Promise ..	A. Moreland and Son, Te Rapa	2 13	241·8	313	6,920·4	413·00
Sultan's Ixia ..	D. A. B. Allison, Pukekohe	1 357	240·5	365	7,969·5	412·26
Besses Bright Princess	H. Stonex, Bell Block ..	1 363	240·5	342	6,592·9	410·25
Kolina	L. Kavanagh, Waihi, Hawera	2 8	241·3	365	7,821·3	409·95
Beaumont Hazel ..	C. J. Masters, Hunterville ..	2 29	243·4	316	8,125·1	409·70
Auroa Molly ..	J. C. Duff, Auroa ..	1 333	240·5	359	8,618·7	409·29
Ngahiwi Exile's Primrose	W. J. Freeth, Waitara ..	1 352	240·5	365	6,859·8	407·75
Agatha of Aria ..	M. V. Reeve-Smith, Aria ..	2 18	242·3	299	6,930·1	404·97
Miss Dudu ..	G. R. and H. Hutchinson, Auckland	1 334	240·5	364	7,020·1	402·08
Holly Oak Anella ..	T. H. Western, Bell Block..	1 357	240·5	336	7,235·8	400·78
Tirvean Pride ..	R. W. B. Evans, Weraroa ..	2 15	242·0	365	7,144·5	400·04
Coniston Gold ..	R. Waterhouse, Ardmore ..	1 191	240·5	362	5,756·8	396·69
Roslyn Rona ..	A. J. Harris, Bombay ..	2 4	240·9	353	6,366·1	396·58
Penrose Flower ..	J. B. Clemow, Stratford ..	1 350	240·5	365	6,386·6	396·48
Klaver†	C. Stevens, Maungatapere ..	1 301	240·5	365	6,965·3	395·82
Jersey Meadows Princess	H. H. Phillips, Te Rehunga	2 5	241·0	365	6,921·7	391·24
Jersey Park Delight ..	W. H. Waterhouse, Runciman	2 6	241·1	303	6,995·6	389·28
Distinction's Duchess	W. P. Begg, Arapohue ..	2 24	242·9	364	7,010·6	386·46
Fanchette's Free ..	B. N. and W. A. Sandilands, Feilding	1 354	240·5	365	7,791·6	381·04
Wyndale Sunflower ..	A. O. Brown, Kamo ..	1 363	240·5	365	7,630·3	379·35
Omagh Beauty ..	R. K. Garland, Matamata ..	1 326	240·5	289	8,561·4	375·95
Marigold's Pet ..	D. A. B. Allison, Pukekohe	2 28	243·3	365	6,059·4	371·06
Darling Beauty ..	S. R. Lancaster, Palmerston North	2 2	240·7	356	6,706·9	370·62
Rosedale Brownwing	E. J. Adams, Puni ..	2 13	241·8	365	6,879·5	364·07
Patch's Iris ..	F. J. B. Ryburn, Paterangi	1 363	240·5	304	6,223·2	360·86
Awatea Belle ..	L. A. Lancaster, Palmerston North	2 14	241·9	329	6,102·0	357·76
Replete	J. Standen, Dalefield ..	1 359	240·5	297	7,020·3	352·75
Jersey Meadows Myrtle	H. H. Phillips, Te Rehunga	2 1	240·6	333	5,810·2	351·62
Ruby's Princess ..	L. Hall, Washdyke ..	1 226	240·5	365	5,594·2	346·33
Braeside Cloe ..	J. Mitchell, Hopelands ..	2 32	243·7	344	6,851·2	344·06

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
		JERSEYS—*continued.*					
Junior Two-year-old—continued.		Yrs.	dys.	lb.		lb.	lb.
Brookley Pet	W. Johnson, Ngaere	1	364	240·5	358	5,650·0	340·44
Kelvin Fancy	G. Buchanan, Paeroa	2	5	241·0	340	6,286·0	336·42
Awaroa Rona	G. Bright, Otaua	1	357	240·5	352	5,694·2	328·15
Mermaid's Queen	W. H. Waterhouse, Runciman	2	54	245·9	277	5,554·8	322·40
Tolgarth Oakless	J. Standen, Dalefield	2	5	241·0	294	5,708·9	321·19
Proud Duchess	G. Hodgson, Whakapara	1	325	240·5	299	6,099·9	318·28
Tongahoe Clematis	R. Hicks, Hawera	1	363	240·5	335	6,944·5	316·72
Eunice's Betty	J. H. Sherrard, Otaua	1	295	240·5	348	5,190·3	304·15
Glenavon Twin Pride	J. Townsend, Puni	2	7	241·2	365	5,199·3	302·38
Jersey Meadows Spright	H. H. Phillips, Te Rehunga	1	334	240·5	330	5,318·8	302·04
Glenavon Twin Joy	J. Townsend, Puni	2	8	241·3	365	5,369·2	296·01
Lyndon Daisy	R. J. Johnston, Runciman	1	269	240·5	328	5,562·6	290·94
Belvedere Dewberry	R. R. Dean, Te Kumi	2	50	245·5	300	5,510·7	290·57
Tongahoe Acorn	R. Hicks, Hawera	2	47	245·2	319	5,193·6	289·33
Tongahoe Dancer	R. Hicks, Hawera	2	12	241·7	314	5,763·9	281·15
Omagh Favourite	R. K. Garland, Matamata	1	329	240·5	245	6,157·8	280·59
Gowanbrae Olga	E. M. Peffers, Feilding	2	19	242·4	191	5,387·8	278·83
Persienne	J. H. Bentley and Sons, Kaponga	2	9	241·4	291	4,691·9	271·74
Royton Alice	H. Moreland, Newstead	1	358	240·5	343	5,299·0	266·39
Senora Patricia	F. E. Ford, Maungaturoto	1	333	240·5	271	3,831·9	262·49
Hillview Fantastic	Hunter Bros., Te Kowhai	1	335	240·5	209	4,862·4	242·52
Fencourt Fairy	R. Wattam, Cambridge	1	348	240·5	330	4,458·8	241·33
Senior Two-year-old.							
Marshland's Briar Eminent†	W. J. Chynoweth, Pukeroro	2	354	275·9	365	10,189·5	599·79
Jersey Lea Tea Rose	S. Bowker, Ihakara	2	362	276·7	365	9,410·0	558·14
Mauriaena Lurline	A. S. Lindsay, Whatawhata	2	279	268·4	365	9,664·0	541·09
Bilberry's Keepsake	W. Pollock, Hawera	2	276	268·1	347	9,462·5	537·91
Mary's Fancy's Sweet	J. R. Colson, Waihou	2	336	274·1	365	8,771·8	527·39
Ivry Rosalie	H. W. Le Bailly, Buckland	2	339	274·4	365	7,743·6	521·32
Foxglove's Pet	J. R. Colson, Waihou	2	340	274·5	349	10,308·0	499·99
Penrose Lass	J. B. Clemow, Stratford	2	363	276·8	365	8,675·8	498·25
Genteel's Neta	J. R. Colson, Waihou	2	313	271·8	365	7,846·8	486·52
Pukaki Rose	W. Robinson, Patumahoe	2	252	265·7	342	8,380·9	483·59
Cloverlea Snowdrop	D. P. F. Malone, Kaponga	2	330	273·5	363	8,100·4	460·26
Jersey Oaks Highland Mary	G. Milligan, Maungateretere	2	317	272·2	344	6,924·1	442·12
Fancy Fair	J. R. Colson, Waihou	2	356	276·1	340	8,878·8	422·01
Heatherlea Sunbeam	H. J. Lancaster, Levin	2	271	267·6	365	7,449·5	418·93
Picquette's Pansy	J. R. Colson, Waihou	2	308	271·3	359	7,227·8	386·29
Ebor's Cissie	R. J. Wilson, Putaruru	2	350	275·5	302	7,055·1	373·39
Exile's Morelle	R. Waterhouse, Papakura	2	337	274·2	355	6,078·5	367·71
Glory Bright	H. E. Walters, Waitoa	2	283	268·8	325	5,966·0	357·04
Gowanbrae Yankee Lass	E. M. Peffers, Fielding	2	342	274·7	201	7,039·5	308·73
Three-year-old.							
Round Bush Holly†	W. T. Williams, Pukehou	3	332	310·2	365	10,352·8	680·68
Jersey Brae Royalty	W. Robinson, Patumahoe	3	364	313·4	365	8,423·0	633·04
Oak Farm Actress	G. B. Knowles, Tariki	3	353	312·3	365	10,660·7	625·08
Rambler Rose	P. A. Anderson, Levin	3	345	311·5	365	11,391·5	623·35
Queen's Dark Lady	R. Waterhouse, Papakura	3	269	303·9	365	9,046·2	591·45
Ebor's Fanny	R. J. Wilson, Putaruru	3	307	307·7	340	9,246·5	588·88
Awatane Betsy	C. J. Masters, Hunterville	3	352	312·2	358	11,854·5	579·59
Vertex	A. S. Lindsay, Whatawhata	3	344	311·4	365	9,863·6	573·63
Queen Marjorie's Maid†	R. S. Tuck, Waharoa	3	0	277·0	365	9,254·0	557·06

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Three-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Belvedere Golden Pride	R. Wattam, Cambridge ..	3 93	286·3	365	8,785·4	543·93
Rosedale Redwing ..	E. J. Adams, Puni ..	3 268	303·8	342	10,624·6	542·29
Cherry's Model ..	J. R. Colson, Waihou ..	3 312	308·2	365	8,356·0	529·85
Golden Forest Flower	J. Robinson and Sons, Otaki	3 339	310·9	365	9,556·9	519·71
Jersey Brae Briar Rose	A. O. Brown, Kamo ..	3 356	312·6	365	10,043·6	511·84
Ratanui Tres Bon ..	J. Robb, Westmere ..	3 342	311·2	365	11,281·6	507·57
Woodland's Pansy ..	F. V. Green, Midhirst ..	3 246	301·6	365	8,169·6	506·37
Signor's Fancy ..	G. Buchanan, Paeroa ..	3 316	308·6	344	8,828·9	503·10
Engdale Cowslip ..	A. S. Lindsay, Whatawhata	3 313	308·3	365	8,160·5	499·53
Imperial's Fascination	G. Buchanan, Paeroa ..	3 170	294·0	345	9,273·8	488·40
Viola's Golden Lady	M. V. Reeve-Smith, Aria ..	3 9	277·9	283	8,396·2	477·23
Miro Meadows Carnation	A. A. Ward, Tariki ..	3 318	308·8	365	9,009·3	474·04
Sedgemoor Rose ..	Miss E. J. Miller, Pirongia	3 56	282·6	343	8,087·9	453·45
Rosy Creek Life ..	C. P. Crowley, Kaponga ..	3 16	278·6	365	8,870·7	453·26
Tirohia Silver Fir ..	A. E. Peppercorn, Cambridge	3 353	312·3	359	9,621·6	442·63
St. Brigid	F. I. Washbourn, Timaru ..	3 232	300·2	365	8,921·9	440·89
Elf's La Primevere ..	J. Robb, Westmere ..	3 27	279·7	365	6,800·0	436·15
Ebor's Rose ..	R. J. Wilson, Putaruru ..	3 328	309·8	312	8,131·1	431·64
Thornycroft Queen ..	S. J. Bennett, Kaupokonui	3 290	306·0	365	7,787·5	418·60
Barnaigh Princess ..	W. T. S. Wilson, Otahuhu ..	3 239	300·9	365	6,802·4	413·26
Fair View Meadow ..	A. Hazelton, Waihou ..	3 361	313·1	286	7,746·5	393·71
Silverdale Butterfly ..	G. Hodgson, Whakapara ..	3 268	303·8	323	7,536·8	385·24
Silverdale Pansy ..	H. Doel, Taumarere ..	3 105	287·5	326	6,677·3	370·78
Jersey Lea Pride's Pet	S. Bowker, Ihakara ..	3 362	313·2	279	6,865·7	363·07
Ratanui Delight ..	W. E. Pilcher, Raumati ..	3 361	313·1	365	7,930·3	358·23
Pine Grove Lass ..	J. Luke, Whakatiri ..	3 15	278·5	265	6,532·7	356·32
Earlston Ruby ..	Chisholm Bros., Hunterville	3 42	281·2	299	6,298·3	344·61
Hawkesbury Caroline	W. E. Pilcher, Raumati ..	3 324	309·4	365	6,539·1	323·31



TRETHELLA SUNLIGHT (J. D. BROWN, WERAROA).

C.O.R., 1924, in Jersey three-year-old class: 13,726·4 lb. milk, 733·29 lb. butterfat.

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued*.					
		Yrs. dys.	lb.		lb.	lb.
Four-year-old.						
Oak Farm Magic Wand	G. B. Knowles, Tariki	4 341	347·6	365	11,681·6	653·94
Gowanbrae Daisy	R. W. B. Evans, Weraroa	4 18	315·3	365	11,346·1	625·67
Holly Oak's Primrose	G. R. and H. Hutchinson, Auckland	4 129	326·4	354	10,891·6	607·67
Meadowvale Black Pearl	O'Sullivan and Sons, Tariki	4 349	348·4	350	11,003·3	601·89
Admiral's Belle	E. Joyce, Kaponga	4 6	314·1	365	9,832·3	598·92
Patch's Maori Girl	E. Joyce, Kaponga	4 48	318·3	365	9,255·0	592·11
Sedge	R. R. Dean, Te Kumi	4 345	348·0	365	10,415·3	583·93
St. Aubin's Mignonette	H. Peoples, Drury	4 262	339·7	365	10,683·3	581·07
Holly Oak's Alma	W. P. Begg, Arapohue	4 111	344·6	365	8,532.4	579·13
Faith	P. McNaughton, Morrinsville	4 4	313·9	365	10,426·5	562·00
Violet's Gem	G. Hodgson, Whakapara	4 277	341·2	345	9,533·5	537·14
Glenlivet Daydream	W. H. Tippins, Opunake	4 72	320·7	365	9,427·3	528·12
Oak Farm Beauty Spot	G. B. Knowles, Tariki	4 13	314·8	360	9,531·5	483·18
Silverdale Bella	G. Hodgson, Whakapara	4 62	319·7	357	10,198·3	478·07
Springbank Ringlet	E. S. Holdaway, Ballance	4 362	349·7	354	8,970·1	457·04
Mayfield's Garnet†	W. J. Chynoweth, Pukeroro	4 41	317·6	365	9,049·1	446·29
Noble Fern Leaf	G. Hodgson, Whakapara	4 5	314·0	342	8,520·9	433·09
Woodstock's Fay	Miss E. J. Miller, Pirongia	4 355	349·0	359	8,063·1	398·97
Mauriaena Cleopatra	O. Glynn, Morrinsville	4 22	315·7	325	7,208·3	387·38
Fairy's Butter Maid	W. E. Pilcher, Raumati	4 36	317·1	365	6·721·9	382·11
Alfalfa Marjorie	J. K. Watson, Tatuanui	4 47	318·2	300	7,534·5	364·80
Mature.						
Dianella	R. R. Dean, Te Kumi	5 51	350·0	365	14,841·4	825·42
Bettie's Silver Leaf	G. B. Knowles, Tariki	5 325	350·0	365	15,114·2	722·52
Goneril†	C. G. Gibbons, Ngaere	6 7	350·0	344	12,712·3	718·46
Ivy of O.K.	J. V. Mortensen, Piopio	7 313	350·0	365	10,030·2	692·78
Miro Meadows Topsy	A. A. Ward, Tariki	6 332	350·0	333	12,437·8	682·74
Letta's Twylish	J. Murray, Woodville	5 317	350·0	351	14,094·5	673·45
Avoca's Queenie	W. H. Tippins, Opunake	7 362	350·0	365	12,938·4	652·55
Roslyn Sweet Lady Rose	E. J. Adams, Puni	5 362	350·0	365	10,733·9	652·12
Bay View Lass	J. Nicolson, Hawera	7 333	350·0	362	10,229·5	625·01
Golden Rose Glory	W. T. S. Wilson, Otahuhu	7 18	350·0	365	11,308·4	618·39
Sea Maid	S. Bowker, Ihakara	6 31	350·0	365	10,245·7	603·81
Pierette	J. J. Goodwin, Morrinsville	5 245	350·0	358	9,845·4	600·32
Twylish's Lily	H. W. Beatson, Aorangi	6 347	350·0	365	10,366·8	595·92
Aberbrothock's Flo	W. P. Begg, Arapohue	8 3	350·0	357	11,142·0	594·52
Hillcrest's Lovelight	H. Hall, Kimbolton	5 84	350·0	332	9,977·5	592·32
Connie Brighteyes	E. S. Holdaway, Ballance	5 343	350·0	361	9,782·9	591·04
Vaudeville	G. B. Knowles, Tariki	6 361	350·0	365	10,352·6	571·19
Ada's Maid†	W. J. Chynoweth, Pukeroro	11 44	350·0	357	10,327·8	570·15
Jewel Chimes	G. Hodgson, Whakapara	9 363	350·0	345	8,664·1	559·80
Parisian Diamond	P. A. Anderson, Levin	7 358	350·0	365	9,267·4	547·27
Ivy Bells	W. Johnson, Ngaere	9 4	350·0	345	10,113·8	546·34
Te Aroha Flower	J. A. Dearlove, Te Aroha	6 21	350·0	341	10,524·7	545·08
Fern Grove Xmas Gift	C. J. Masters, Hunterville	8 239	350·0	315	9,896·7	540·87
Dairy Girl	F. V. Green, Midhirst	7 306	350·0	365	8,793·9	529·69
Holly Oak's Lala	F. Jennings, Mauriceville	5 99	350·0	292	9,666·5	526·23
Larkspur	H. Peoples, Drury	9 10	350·0	365	9,648·1	526·19
Aberbrothock's Maggie	D. Marra, Dargaville	7 359	350·0	365	10,389·3	523·35
Darkie's Promise	Brakenridge and Pearson, Taupaki	5 172	350·0	365	9,576·2	520·70
Fairview Ruby	R. R. Dean, Te Kumi	5 43	350·0	355	10,272·3	517·25

LIST OF RECORDS—*continued.*

Name of Cow and Class	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS—*continued.*				
Mature— continued.		Yrs. dys.	lb.		lb.	lb.
Foxbane	W. S. Carter, Palmerston N.	5 276	350·0	365	10,556·9	515·91
Silver Birch ..	W. S. Carter, Palmerston N.	7 292	350·0	353	9,572·3	515·09
Engari	E. O'Sullivan and Sons, Tariki	6 346	350·0	355	10,596·5	509·46
Meadowvale Peg o' My Heart	E. O'Sullivan and Sons, Tariki	5 346	350·0	364	10,001·4	505·89
Fairy Frolic ..	E. T. Burke, Otakeho ..	6 335	350·0	365	10,589·4	503·79
Morva	J. H. Bentley and Sons, Kaponga	5 357	350·0	365	9,151·7	496·49
Tahua Orange Blossom	J. I. Fox, Aorangi ..	7 342	350·0	261	9,252·2	489·74
Fanchette	B. N. and W. A. Sandilands, Feilding	9 205	350·0	357	7,973·7	489·58
Willowbank's Surety	T. Ranford, Palmerston North	7 19	350·0	365	8,011·3	488·03
Bonny Girl.. ..	F. V. Green, Midhirst ..	6 249	350·0	365	7,947·6	485·55
Bilberry's Gem ..	W. Pollock, Hawera ..	7 304	350·0	319	8,767·6	485·50
Flower's Joy ..	D. L. A. Astbury, Mangatoki	7 361	350·0	332	9,510·7	484·68
Uranium	A. Hazelton, Waihou ..	7 21	350·0	334	7,518·8	482·75
Hillcrest's Orange Blossom	J. A. Dearlove, Te Aroha ..	8 341	350·0	365	9,027·1	476·00
Fernaig Blossom ..	H. W. Le Bailly, Buckland	9 262	350·0	365	8,206·1	467·23
Wai Whenua Carissima	R. J. Wilson, Putaruru ..	7 168	350·0	315	8,522·5	467·22
Noble Fern ..	C. Stevens, Maungatapere ..	5 254	350·0	365	7,727·8	465·74
Star's Dairymaid ..	G. B. Hull, Wellington ..	7 360	350·0	339	9,614·6	464·98
Moss Rose	L. A. Lancaster, Palmerston North	5 359	350·0	364	9,255·3	461·16
Mosul	C. Stevens, Maungatapere ..	6 8	350·0	346	7,962·2	460·70
Waireka	H. J. Lancaster, Levin ..	12 20	350·0	336	9,916·9	458·54
Silverdale Nell ..	G. Hodgson, Whakapara ..	5 5	350·0	347	9,512·6	450·45
Waimarie ..	W. Pollock, Hawera ..	8 354	350·0	320	8,169·4	448·41
Springfield Betty ..	H. Peoples, Drury ..	8 288	350·0	312	7,769·7	447·47
Butter Lady ..	W. E. Pilcher, Raumati ..	11 305	350·0	365	8,280·7	441·47
Silverdale Prim ..	G. Hodgson, Whakapara ..	5 101	350·0	334	8,966·3	440·27
Tikorangi Golden Bell	J. Cloke, Lepperton ..	6 292	350·0	315	7,468·1	439·29
Pet's Pride ..	H. R. Snell, Ngunguru ..	7 215	350·0	365	7,319·1	423·80
Springbank Dot ..	E. S. Holdaway, Ballance ..	7 41	350·0	352	7,858·7	423·02
Butter Lady's Creamy	W. E. Pilcher, Raumati ..	6 232	350·0	364	7,256·5	423·01
Lily's Zealandia ..	A. Hazelton, Waihou ..	6 300	350·0	283	8,160·3	418·45
Mystery Lass ..	W. H. Waterhouse, Runciman	8 355	350·0	257	7,296·1	415·60
Brooklyn's Caramel ..	H. J. Lancaster, Glen Oroua	6 23	350·0	310	8,714·5	414·37
Miro's Lass ..	J. Poletti, Bell Block ..	5 363	350·0	332	6,458·5	411·34
Optician's Prim's Rose	W. E. Pilcher, Raumati ..	8 305	350·0	360	7,100·0	407·52
Pocahonta's Peggy ..	J. Klenner, Kaimata ..	6 318	350·0	359	5,966·6	406·93
Silverdale Duchess ..	G. Hodgson, Whakapara ..	5 324	350·0	325	7,278·8	402·78
Melia's Ann's Beauty	R. W. B. Evans, Weraroa ..	11 304	350·0	319	7,679·3	400·93
Besses Passion Flower	G. R. and H. Hutchinson, Auckland	5 349	350·0	344	7,200·6	395·06
Lady Lucerne ..	R. K. Garland, Matamata ..	8 110	350·0	298	7,406·5	392·81
Rewarder's Dot ..	A. Hazelton, Waihou ..	6 27	350·0	259	6,992·4	372·24
Renona	R. K. Garland, Matamata ..	7 274	350·0	357	6,756·4	350·84
		FRIESIANS.				
Junior Two-year-old.						
Waverley Maid* ..	T. R. Eades, Edendale ..	2 103	250·8	365	18,430·6	587·58
Cornucopia Pontiac Paxton†	Hodgson Estate, Tamahere	2 152	255·7	364	18,579·7	563·70

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
			FRIESIANS —*continued.*			
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Brookside Pietje Johanna†	Cameron Bros., Stratford ..	1 327	240·5	338	15,525·3	540·25
Pauline Pietertje Alcartra*	J. E. O'Shea, Ohangai ..	1 358	240·5	365	14,940·2	537·12
Bywell Daisy Paxton†	T. H. Richards, Cardiff ..	2 65	247·0	365	14,186·0	520·03
Lady Johanna Paul Pontiac*	John Court, Ltd., Auckland	2 96	250·1	365	12,824·7	505·78
Belle of Dominos* ..	W. I. Lovelock, Palmerston North	2 94	249·9	365	12,097·4	448·68
Glenmore Nazli Domino†	D. H. Johnson, Stratford ..	1 319	240·5	362	10,179·4	383·42
Dominion Mutual Mercedes Beets	Central Development Farm, Weraroa	1 298	240·5	364	10,660·9	380·07
Dominion Colantha Beets	Central Development Farm, Weraroa	2 9	241·4	357	10,534·6	368·46
Dominion Countess de Kol	Central Development Farm, Weraroa	1 319	240·5	320	9,326·3	366·03
Kowhai Tip ..	W. A. Kyle, Palmerston N.	1 334	240·5	318	8,698·9	284·79
Anawhata Belle Pietertje Segis	P. F. Boucher, Kumeu ..	1 283	240·5	361	7,916·4	279·94
Lady Bonheur† ..	C. Boyce, Tatuanui ..	1 311	240·5	333	7,406·2	279·54
Senior Two-year-old.						
Cluny Pietje Kate 15†	Hodgson Estate, Tamahere	2 325	273·0	365	13,731·3	489·14
Oaklands Springhill 2nd*	John Court, Ltd., Auckland	2 324	272·9	334	11,821·9	473·36
Friens Mercedes Johanna†	D. Dickie, Wellington ..	2 186	259·1	365	11,672·2	433·76
Miller Chloe Segis Aaltje*	John Court, Ltd., Auckland	2 267	267·2	365	11,748·5	376·87
Grahamholm Lady May Ormsby*	John Court, Ltd., Auckland	2 223	262·8	334	9,325·4	334·39
Dominion Colantha Fayne	Central Development Farm, Weraroa	2 291	269·6	331	10,412·4	327·80
Junior Three-year-old.						
Roslyn Blanco Johanna Pontiac†	Waitemata Stud Farm, Auckland	3 70	284·0	329	9,698·3	393·32
Bonheur Lassie† ..	C. Boyce, Tatuanui ..	3 10	278·0	315	9,120·9	349·15
Senior Three-year-old.						
Pareora Domino Van Thumper*	A. S. Elworthy, Timaru ..	3 260	303·0	365	16,530·1	638·67
Sadie of Avonmore* ..	J. McAnulty, Ashburton ..	3 293	306·3	365	14,691·3	571·98
Coldstream Magpie Lassie	C. H. Silby, Aratapu ..	3 364	313·4	267	8,818·1	415·08
Junior Four-year-old.						
Bainfield Topsy 10th*	O. A. Cadwallader, Greytown	4 132	326·7	365	22,456·0	863·89
Senior Four-year-old.						
Pareora Snow† ..	A. S. Elworthy, Timaru ..	4 357	349·2	365	20,238·8	680·37
De Kol Pearl* ..	Matangi Friesian Farm Co., Matangi	4 310	344·5	300	12,607·5	481·84

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Mature.		Yrs. dys.	lb		lb.	lb.
Monavale Queen Bess*	T. H. Richards, Cardiff ..	5 329	350·0	333	25,598·0	950·90
Coldstream Magpie Domino†	G. A. Marchant and Sons, Cardiff	5 315	350·0	365	19,759·4	924·47
Zozo II of Ashlynn* ..	John Court, Ltd., Auckland	8 259	350·0	365	23,274·7	905·89
Janette Segis Oak* ..	John Court, Ltd., Auckland	7 179	350·0	365	25,573·8	787·63
Segis Grace Homestead*	Matangi Friesian Farm Co., Matangi	6 17	350·0	276	18,112·0	689·11
Friens Mercedes Aquila†	D. Dickie, Wellington ..	5 318	350·0	365	21,589·3	665·39
Waihi Milkmaid† ..	D. H. Johnson, Stratford ..	6 27	350·0	356	19,013·2	628·50
Segis Lady Waihi* ..	D. H. Johnson, Stratford ..	5 342	350·0	357	17,439·3	609·34
Queenette Pietertje* ..	Matangi Friesian Farm Co., Matangi	8 360	350·0	249	13,254·9	570·71
Coldstream Colantha Princess*	G. A. Marchant and Sons, Cardiff	5 261	350·0	286	15,890·3	519·25
Woodlands De Kol Lady*	John Court, Ltd., Auckland	9 174	350·0	365	15,081·8	498·87
Lady Royalist† ..	C. Boyce, Tatuanui ..	9 191	350·0	317	13,781·9	478·06
Peria Queen ..	J. H. Wilson, Matamata ..	5 340	350·0	317	11,819·5	460·84
Pontiac Jewel Aagie ..	J. H. Wilson, Matamata ..	11 180	350·0	311	13,235·8	457·30
Princess Mercena Pontiac*	John Court, Ltd., Auckland	5 299	350·0	365	13,973·0	452·40
Johanna Van Segis ..	W. A. Kyle, Palmerston N.	6 80	350·0	312	12,426·5	412·21
Pine Grove's Pride de Kol	E. J. Betts, Okaiawa ..	5 364	350·0	324	12,041·1	379·00
	MILKING SHORTHORNS.					
Senior Two-year-old.						
Mereside Gem ..	W. Bowis, Doyleston ..	2 350	275·5	365	11,286·3	461·52
Senior Three-year-old.						
Eleam Minnie ..	Hanson Bros., Parakai ..	3 319	308·9	365	10,143·2	433·34
Mature.						
Kaitawa Mabel 2nd† ..	J. H. Mason, Feilding ..	7 318	350·0	353	16,115·4	569·77
Matangi Daphne's Darling†	Simms and Son., Ltd., Halswell	5 39	350·0	310	10,205·1	406·92
	AYRSHIRES.					
Three-year-old.						
Prudence of Braeside	Robertson and Blackley, New Plymouth	3 346	311·6	318	10,474·7	389·03
Mature.						
Glencairn Brownie† ..	A. Montgomerie, Kauwhata	8 360	350·0	365	15,579·4	728·05
Glencairn Jenny Lee†	A. Montgomerie, Kauwhata	5 311	350·0	365	15,433·0	694·28

Second-class Certificates.

Jerseys.

Mature.						
Lucky Dorothy Cactus†	C. Stevens, Maungatapere ..	6 204	350·0	365	12,483·5	649·21
Silverdale Katherine	G. Hodgson, Whakapara ..	6 240	350·0	365	7,677·1	483·53

Friesians.

Junior Two-year-old.						
Dutch Queen Segis*	W. I. Lovelock, Palmerston North	2 58	246·3	365	10,694·4	368·90

SEASONAL NOTES.

THE FARM.

HILLSIDE ENSILAGE-PITS.

Where suitable banks are to be had in handy positions the hillside pit is an excellent method for making ensilage, and frequently one can be provided in each field or made where it will suit two or three paddocks. In choosing the site for a hillside pit, care should be taken to see that it can be conveniently filled from above, and that a good road can be had from the front of the pit for carting out the material. A round pit is much better than a square one, as it is difficult to fill the corners satisfactorily in the latter so as to exclude the air, and there is often considerable loss from this cause. The walls should have a slight batter, 1 in 15 being about right. The opening to a round pit should, if possible, be just wide enough to allow a dray to back in, and where the pit is to be permanent the corners of the opening should be cemented so as to carry timber to close the opening as the stack is being filled. In the case of a temporary pit a good stout post may be placed at these corners, and timber for closing the opening should not be less than 2 in. stuff. In filling the pit, great care should be taken to see that it is evenly filled and that the sides are well tramped, so that there is no possible chance of the material shrinking from the walls and admitting air. The same precautions are necessary in filling a pit as in building a stack to see that the temperature is properly controlled. The following is the approximate holding-capacity of round pits or silos: 20 ft. by 10 ft., 30 tons; 20 ft. by 12 ft., 45 tons; 24 ft. by 12 ft., 55 tons; 20 ft. by 14 ft., 60 tons; 30 ft. by 12 ft., 75 tons; 30 ft. by 14 ft., 100 tons.

THE SWEDE CROP.

Where December sowing of swedes is practised the land should now be well cultivated in preparation. A fine, firm, moist seed-bed is required, and care should be taken that the seed is not buried, as frequently happens when the drill is set on a firm headland and then taken on to the softer cultivated soil. Local experience must be the guide in deciding the best time to sow. In general, the later the sowing is made the less danger will there be from dry-rot; but, on the other hand, if left too late dry weather may result in a poor strike. A suitable seeding is from 10 oz. to 14 oz. per acre through every second coulter, with from 2 cwt. to 3 cwt. of manure. Fertilizers should consist of quick-acting phosphate, in order to promote rapid growth during the early stages when the plants are subject to insect attack, and a slow-acting phosphate to carry on the growth well into the winter. Mixtures, depending on the soil and other conditions, of equal parts of superphosphate and of one or other of Ephos phosphate, basic slag, bonemeal, or Nauru rock phosphate have all given good results. On old land the addition of ½ cwt. sulphate of potash per acre will give in many cases good results. The seed and fertilizer should be mixed immediately before sowing, and not left to stand mixed.

SOFT TURNIPS.

Late sowings of soft turnips for feeding dairy stock may be made in December, and for autumn and early winter feeding the green-top varieties will generally be found best. Green Globe and Green-top Aberdeen are two good varieties, and sown towards the end of the month will keep well into the winter.

THINNING AND INTERCULTIVATION OF MANGOLDS.

Mangold crops should be thinned as early as possible in the coming month, so as to get rid of weeds between the plants and allow them to become well established before dry weather sets in. A thinning to 1 ft. apart will be found good practice generally. Wider thinning is often advised, but except on very good soils heavier and better crops are grown when the plants are close together. Yellow Globe varieties, however, may be thinned to 15 in. with advantage. Should the plants be pale in colour and showing poor leaf-formation at thinning-time a top-dressing of ½ cwt. to 1 cwt. of nitrate of soda will help to push them along, and often produces a considerable increase in the yield.

Intercultivation with the hand or horse hoe should be frequent and thorough during December and January. This cultivation has generally more effect on the resulting crop than the initial manuring. Even when free from weeds mangolds benefit to a marked extent by a frequent stirring of the soil between the rows. This operation promotes root-growth and prevents excessive evaporation of soil-moisture, which latter is generally in short supply during the summer. The soil should not be banked around the plants (especially with the Globe varieties), but rather drawn away from them, and the outside tines of the cultivating-implement should be set to do this.

CLOVER AND LUCERNE SEED.

Clover fields intended for seed have in many cases been badly trampled and puddled during the winter and spring. The cutting of white-clover crops in such fields, when the knife has to be placed very close to the ground, is apt to be exceedingly hard on the mower. With land in this condition it will be well to await a favourable opportunity for improvement. After there has been a fall of rain just sufficient to slightly soften the ground it may be possible to roll the surface down. Any attempt to roll on clay land when the ground is hard and scarred with hoof-marks will be time wasted. In the case of red-clover paddocks rolling will not be so necessary, as the mower-knife cuts higher above the ground.

Owing to the recent sharp rise in the price of lucerne-seed it is probable that a considerably larger area in Marlborough will be shut up for seed this season. On the lighter soils stands which have received the ordinary spring cultivation with the stiff drag cultivators and a winter top-dressing of superphosphate will, in the ordinary course, be hayed in November, then shut up, and cut again for seed about January or February. On the heavier soils, where the growth of stem and leaf is rank, it may be necessary to open the spaces between the plants by rigorous cultivation. To secure high yields of seed the access of light and air is essential. Great bulk of foliage is generally incompatible with high seed-yield.

SOME HAYMAKING HINTS.

In considering the hay crop it should always be remembered that quality is of greater importance than quantity. Often meadow hay is not cut until the grass-plants have gone to seed and the hay has lost much of its nutritive value. Quality passes away with maturity, and the highest quality can only be secured by mowing at the proper time —that is, when the predominant varieties of grasses are in flower.

Haystacks should always be built on a well-drained site, using a good bottom of old posts or hedge-brushings. The sides should be carried slightly outwards as building proceeds, and the heart of the stack kept well mounded up. A flat roof must be carefully avoided. Care should also be taken that those working on the stack do not stand for long at any one point, otherwise the roof will settle unevenly and wet places tend to form.

The horse-rake is often wrongly used. It is lightly built and easily strained, and, while it may be quite legitimately used for gathering the hay in to windrows, it should never be used for collecting large quantities into cocks or dumps. The sweep will pick up a windrow quite well if the horses move briskly, and it is as easy to load a dray from a windrow as from a dump.

With regard to special hay crops, it was noticed last season in a number of cases that oats and peas were allowed to approach the ripening stage before being cut. If best results are to be obtained from this crop a much earlier cutting must take place. The right time is when the peas are well in flower, and at that period the oats will also be at the right stage.

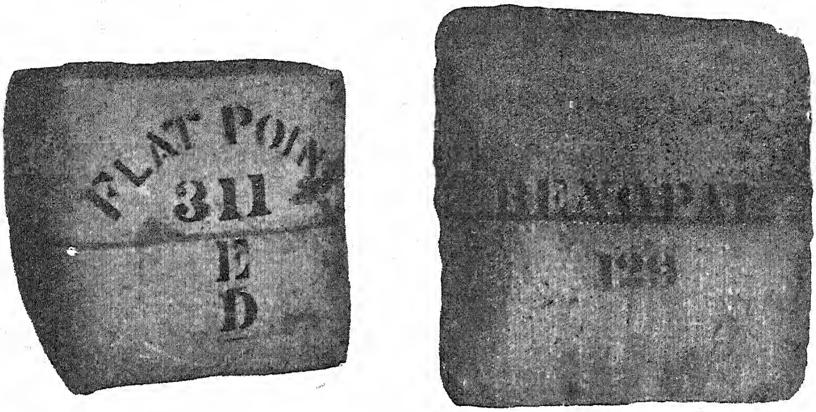
—*Fields Division.*

BRANDING, WEIGHING, AND BOOKING OF WOOL-BALES.

These matters — especially branding — require more attention by many sheepfarmers. The bale should be branded on both ends with the station or farm name and the number; the class of wool in the bale may also be branded if desired. Say it is A combing, Romney Marsh hogget: the letters A over RM over H will do; or if it is wethers, W will suffice. Brands should be stencilled in black ink, in upright block letters not less than 3 in. in height. Brands must consist of not less than three letters. Double marks, conjoined letters, or fancy signs which cannot readily be transcribed should be avoided. The bales should also be numbered consecutively with figures at least 3 in. in height.

The proper stencilling cake or powder should be used for branding. If a cake, knock off about one-quarter and break this into small pieces; put these into a tin receptacle and pour in boiling water, which will dissolve the pieces quickly. When cool, pour into a bottle, cork, and use the liquid as required, diluted with cold water if too thick. Into an enamel or tin plate put a small piece of wool; pour some of the liquid on this, and when branding the bale dip the brush into the plate (this ensures an even supply of the fluid) and rub the brush over the stencil-plate. If a station or farm has a private mark, put this on the bale first; the name of the station next in the middle; then the number of the bale underneath.

If scales are available it is best to have the bale weighed. Bales of wool should not weigh more than 4 cwt., as for over 4 cwt. the railage charges are higher; for over $4\frac{1}{2}$ cwt., charges for wharfage, dumping, handling, cartage, &c., are half rate extra, and for over 5 cwt. the charges are double.



WELL-BRANDED BALES.

Left: Bale with name of station, number, and description of wool. Right: Bale with name of station and number; this latter branding suffices and is recommended generally.

All bales as soon as they are branded and weighed should be duly entered in the wool-book, with the number of bale in left-hand column, description of wool in the bale in the wide column, and the weight in the three columns on the right. When sending the wool to market the numbers should be forwarded consecutively, for the convenience of the firm handling the clip. An invoice copied from the wool-book should also be supplied to the firm as each load leaves the shed.

—*J. G. Cook, Wool Instructor, Live-stock Division.*

THE ORCHARD.

HANDLING THE STONE-FRUIT CROP.

By the end of November growers will have a pretty good idea of the crop prospects for the season. Stone-fruits will be nearly ready for harvest, and cases will need to be secured and made up in readiness. In some localities second-hand cases are largely used, and growers should bear in mind that serious risks are entailed by this practice, owing to the fact that spores of brown-rot fungus are likely to be lodged in cracks and crevices, which attack the fruit in transit. Where these cases are used growers should take the precaution to treat the cases and lids with a solution of pure bluestone, 1 lb. to 20 gallons water, sufficiently in advance of packing to allow them to dry before using. Where railway fruit-trucks are in constant use the same treatment could be also applied with advantage.

In the marketing of stone-fruits the greatest care should be taken to ensure the fruit arriving on the market in the best condition. A slightly hard fruit may be worth something, but rotten fruit is a loss to all concerned. At the same time one should refrain from picking immature fruit. Size and pack the fruit well, and market specially selected samples in trays where this is convenient. There are outlets for all grades, and they should be kept separate for the purpose of diverting them into the proper channels.

ATTENTION TO PIP-FRUITS.

Now is the time for growers to think ahead. It may appear premature to talk of grading for export, but now is the time to start. Where the crop is a good one, thinning will be the important work. Unless one is very lucky there will be some black-spotted fruit to get rid of, and this is best done now. Do not thin indiscriminately; discard the worthless fruit, irrespective of its position on the tree. The lighter-loaded trees are a more difficult problem, and in this case one cannot afford to thin too heavily owing to the difficulty of forcing greater size into the remainder. But the object should be to produce only fruit fit for export grades, and if this were accomplished our local-market problems would be half solved.

SPRAYING.

Much will depend on the developing foliage and crop as to what spraying will now be required for the control of fungus diseases. Should the weather still be unsettled, stone-fruit trees will continue to need attention for brown-rot. Lime-sulphur, 1–125, or 8–8–50 self-boiled, though it may not be a perfect cure, has certainly been proved helpful in minimizing the loss. Black Leaf 40, at 1–1,000, should be added for green aphis if this pest is troublesome.

Apple and pear trees should still receive attention for black-spot and mildew, and the condition of the trees combined with the amount of infection should be the deciding factor as to what strengths of lime-sulphur or sulphur pastes should be used. Growers should obtain the advice of the Orchard Instructor for the district if in doubt as to what course to adopt. Even though fungus diseases may not be in evidence, spraying must be continued for insect pests. Red-mite soon gets out of hand if lime-sulphur is discontinued. Arsenate of lead must be renewed on the trees every fourteen to twenty-one days, according to the weather experienced, if best results are to be obtained against codlin-moth and leaf-roller caterpillar. If leaf-hopper is in evidence Black Leaf 40 should be combined with other materials to secure the best results.

CULTIVATION AND MANURING.

Cultivation should be continued during December, and the green crop grown in good time, especially if blue lupin is to be the crop. Heavily laden trees and trees making poor growth will be benefited by the application of nitrate of soda or sulphate of ammonia during December, at the rate of 1 lb. to 2 lb. per tree according to condition.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

The most important seasonal work in the citrus-grove at this period is spraying. The very unsettled weather prior to flowering precluded in many instances the application of insecticidal sprays, and in most cases lessened the effect of those applied. The young of black scale, mites, and thrip are now active; a spraying of insecticide is therefore required to destroy these and prevent extensive infection. In many groves oil-spraying in winter to early spring is practised, followed by an autumn application. This proves insufficient to give thorough control, and results in a dirty crop, apart from the damage to the tree. Summer insecticides are required for a thorough job. Oil at 1–60, applied alone, or Black Leaf 40 at 1–800, applied with soap or with bordeaux, gives satisfactory results, while lime-sulphur at 1–50 is not quite so good or effective. Oil, 1–60, plus 4–4–40 bordeaux, is so far giving good results, and should be tried in a limited way by those interested. With the fall of the bloom, sprays for verrucosis and grey scab will be advisable. Bordeaux, 4–4–40, should be applied, and repeated at twenty-one-day intervals until the fruit is well grown.

Cultivation should be well maintained, the soil being worked sufficiently to ensure a good tilth, particularly of the top 3 in.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CARE OF GROWING STOCK.

Now that many chickens are half-grown it is well to reiterate that if they are to develop into really profitable stock they must not be neglected in any way. In the first place, good and liberal feeding is imperative, included among which should be an abundance of green food.

Before the young birds are removed from the brooder to the colony house, and especially where adult stock have been previously kept, the whole of the interior of the quarters should be thoroughly cleaned and disinfected as a prevention against parasitic life. One of the strongest points in favour of an incubator is that it does not breed vermin—a source of probably the greatest leakage at the present time in connection with poultry-keeping. It is true that chickens will do well to a greater or lesser extent when with the natural mother, even when infested with vermin, but vermin are practically fatal to the artificially produced chicken.

Another important point in the management of growing stock is to keep the different ages and sexes as distinct as possible, so that the treatment may harmonize with the stage of development of the different-aged birds. On many plants there is altogether too little classification of stock. The best results will never be secured unless the chickens of different ages are penned separately, and the treatment of each pen is in uniformity with the special demands of the particular occupants. When chickens are first drafted from the brooder to the colony house the sleeping portion should be more or less secluded—in other words, similar in all respects to the brooder conditions they have

been removed from. In this way they will be induced to settle down, and the risk of huddling in corners thereby minimized. Perches about 1 ft. from the ground with some grain-sacks placed over them will usually have the effect of preventing huddling. Of course, the sacks should be arranged in such a way that plenty of fresh air is available to the birds at all times. The risk of losses through huddling and its evil effects will also be greatly lessened by rounding the corners of the house with wire netting.

It is a mistake to confine half-grown chickens in a small run or to curtail exercising-space in any way, as this is one of the most common causes of leg-weakness and other troubles. Plenty of exercise is specially necessary for the growing bird to keep it in a healthy, thriving condition. Another requirement is clean ground or a run that has been spelled for some considerable time. A stale run, especially where adult stock have recently had access, is responsible for much of the weedy stock and layers of small eggs, which are becoming far too common. No care or attention is too good for the growing pullet, from which so much will be expected at a later date in egg-production. It must not be forgotten that if a chicken once receives a setback it may never recover.

Good shade, grit, dusting-places, and shelter from wind are also among the requirements for the maintenance of good health in the developing bird.

PURE-BREEDING AND CROSS-BREEDING: CAUTION NECESSARY.

The egg-laying competitions have taught farmers many lessons in regard to the management of poultry, and probably the most important lesson yet conveyed is the great superiority of purebred stock as compared with crossbred or barnyard fowls. Previous to the advent of these competitions the great majority of the fowls kept on the farms were of a crossbred class, and it was generally admitted that they did little more than pay for the food they consumed. Farmers generally preferred the crossbred or barnyard bird for ordinary purposes, rather than what was then considered an ideal show specimen. The reason the show bird was considered unsatisfactory for egg-laying purposes was chiefly due to the judges favouring fancy abnormalities and ignoring points indicative of vitality and egg-laying capacity.

While this is true, the fact should not be forgotten that the greatly increased egg-production that has taken place during recent years could never have been achieved had it not been for the work performed by the fancier, who by careful selection and a love for his work made and brought to perfection the beautiful breeds of poultry we have at our command to-day. The fancier, in fixing types and characters of the various breeds, undoubtedly performed a great work, and still deserves the credit of laying the foundation of all the heavy-producing stock now available. Obviously the making of a breed and bringing it to perfection is of much greater importance than merely improving it from an egg-producing viewpoint. It is recognized by all who have concerned themselves in animal-breeding that it is only the type which has been bred true to a given standard from generation to generation that has the power of transmitting desired character. It is gratifying to know that the great majority of farmers are showing their appreciation of this principle by keeping nothing but pure breeds.

of poultry. There are now few farms where purebred birds are not kept—that is, birds of laying-type combined with egg-productive power and the desired characteristics of the breed they represent.

Farmers in particular would be well advised not to depart from this policy for any other that may be advocated, until at any rate some sound proof is forthcoming of the advantages to be gained. For example, it has been proved by crossing certain breeds of poultry that the sex of the progeny produced from such unions can be ascertained at the time they are hatched. It is claimed that such crossbred stock have a decided advantage from a profit-making viewpoint as compared with progeny produced from a fixed purebred type. The reason for this is, firstly, that no crossbred males need be reared; secondly, because the space they would otherwise take up could be occupied by laying-birds; while it is further claimed that the crossbred pullets are easier to rear and will lay larger eggs and more of them than purebred stock. These claims are all very well in their way, but the fact remains that cross-breeding is nothing more or less than haphazard breeding for the production of any character. As a means of increasing egg-productive capacity it is certainly a "hit or miss" system of breeding as compared with the breeding of purebreds.

It is true that a first cross will often produce a phenomenal egg-yield, but it is generally conceded that the progeny from such a cross when bred from will prove disappointing. Under the new order of things advocated the farmer or poultry-keeper would have three issues in his breeding operations for consideration—the maintenance of two purebred flocks (for it takes two purebreds to produce a first cross), and in addition a third mating for the production of the crossbred stock. Farmers in general would be well advised to keep one pure self-coloured breed of fowls—black or white. In this way the flock will not only present an attractive uniform appearance, but the trouble of mating and classification of stock will be reduced to a minimum as compared with the keeping of two or more breeds, especially where crossing breeds is resorted to.

I would again emphasize that before discarding proved methods of breeding for the adoption of any new and partially tried method the poultry-keeper (the farmer in particular) should carefully weigh the matter well over in the light of common-sense, especially that phase which aims at the production and distribution of crossbred stock throughout the community.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

REQUEENING.

By this time the beekeeper should be able to decide which of his queens are fit to carry on through the season, and which should be destroyed and replaced by new ones. During the swarming season it is a simple matter to obtain good ripe queen-cells for requeening purposes. A few nucleus hives are a valuable asset in any apiary, and may be utilized throughout the summer for the purpose of hatching and mating relays of young queens. In addition to the employment

of queen-cells produced under the swarming impulse (and such cells are usually of the best quality) there are several methods of artificial queen-raising in practice among commercial beekeepers. Most of these are described in any text-book, but are sometimes regarded as too intricate for the average man.

A simple method, and one frequently very successful if only a small number of cells is required at once, consists in raising several frames of eggs and very young brood above an excluder, confining the queen to the bottom story. At the end of ten days or so there should be several good queen-cells on the frames above the excluder ready to transfer to nucleus colonies. These cells should be carefully cut from the combs without any jarring or shaking, and grafted on to combs in the nucleus hives. On no account should the queen-cells be removed before the tenth day. They would really be better left in the parent hive for a longer period, except for the fact that the bees may have raised them from young larvæ, in which case they will be due to hatch on the eleventh or twelfth day. This method is even more likely to ensure success if the combs containing eggs, &c., are placed in the third story with a super of sheets of foundation or empty combs between them and the brood-chamber. In this case, also, the excluder should be placed on top of the brood-chamber. It must be borne in mind that no dequeening is required by this method.

Another simple method, and one more easily controlled by the beekeeper, consists in placing a frame of eggs horizontally over the frames in the brood-chamber. This is best arranged for by placing an empty worker-comb in a strong colony and marking the date on the frame. As soon as the queen has laid in the comb the colony which is to be utilized for queen-raising purposes must be dequeened, and it is best at the time to remove all unsealed brood. This will ensure that all queen-cells will be raised on the specially prepared frame of eggs. If every second and third row of cells is pared down to the midrib, and only one in four of the cells in the remaining rows allowed to contain an egg, a greater number of queen-cells will probably be procured. However, the frame will usually be found quite satisfactory just as it comes from the hive without any paring or cutting. An empty frame must be procured and laid on top of the brood-chamber. On this the frame of eggs is laid, and the whole covered with two or three mats. An empty super must be placed on the hive so that the frame of eggs will not be crushed when the roof is put on. The bees will draw the queen-cells downward, the empty frame allowing room for them to be developed to their full length. If only eggs are used, as suggested, the queen-cells may be safely left on the hives for thirteen or fourteen days after the introduction of the frame of eggs, by which time they will be ready for the nuclei. As soon as the young queens in the nuclei have laid a fair number of eggs they should be removed to replace a failing queen, and their places filled by more ripe queen-cells, until a sufficient number of young queens have been produced to renew the stocks in the apiary.

TREATMENT OF FOUL-BROOD.

As advised in the September issue notes, beekeepers should undertake treatment of diseased colonies as soon as weather conditions permit. All infected stocks should be dealt with so that they may

build up in time to work the main crop. Usually at the end of November the weather is settled enough in all parts of the Dominion to carry out treatment, and in many districts the clover is yielding sufficiently to enable the beekeeper to treat successfully with a minimum amount of feeding. Poor honey crops are almost invariably the result of neglected and diseased stocks, and many beekeepers are apt to blame seasons instead of seeking the enemy within the hives. There is no gainsaying the fact that foul-brood is destructive of more colonies than starvation, and in too many cases the beekeeper is apt to treat the disease as of little consequence, only to wake up later on and find that it has decimated his stocks and reduced his returns to nil. For full particulars as to treatment see the Department's Bulletin No. 119, "American Foul-brood in Bees and its Treatment."

WAX-MOTH.

From time to time advice is asked as to the eradication of this insect pest. Usually these moths are the enemies of the careless bee-keeper and those who have not advanced beyond the box-hive stage. It is the larvæ or grubs which prove so destructive to the combs, burrowing through them under the protection of the silken galleries which they spin round themselves. Eventually the combs are destroyed and fall a mass of cocoons to the bottom of the hive. No better advice can be given for coping with these insect enemies than to keep all colonies strong and to Italianize the apiary. Italians are better able to contend with the pest than blacks. All old and failing black queens should be replaced with vigorous young Italians.

PREPARING FOR THE HARVEST.

Although extracting is still a few weeks ahead in most districts, the honey-house and appliances should be put into proper condition for dealing with the main flow. Any repairs necessary should be undertaken at once, all utensils scoured and sterilized, machinery oiled and overhauled, and, in fact, the whole outfit "spring-cleaned," so that operations may be commenced at short notice. Half the drudgery of extracting may be obviated by complete preparedness for the most important work of the season.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

SMALL-FRUITS.

GROWERS of berry fruits will now be busy harvesting their crops. The gooseberry and strawberry picking will be well under way, and the current and raspberry harvest about to commence. These facts might well be given more publicity by growers' associations. Very few people are aware of the brief period during which these popular berries are available. Were the people acquainted with the facts and a fresh supply made readily available, the consumption would increase greatly. To enable the berries to be supplied in the best condition picking must commence early in the day and the fruit consigned that afternoon. A reasonably even sample should be maintained, both as to maturity and size.

Cape gooseberries and passion-vines should receive regular cultivation at a moderate depth only, in order to maintain a soil mulch, destroy weeds, and encourage growth.

TOMATOES UNDER GLASS.

Tomato-plants growing under glass will now be ripening their lower bunches. The leaves may be trimmed from below the ripening bunch. Make applications of liquid manure at frequent intervals, and now the houses are well filled with plant-growth see that ample ventilation is given in fine weather. The outside crop will now be well established. Suckering and tying should be done as soon as necessary, and in fine weather shallow cultivation given between the rows.

VEGETABLE-GROWING.

In the vegetable section the harvesting of the early crops of potatoes, peas, cabbage, and salads will be taking place. A handy second growth may often be taken from this cabbage crop with a little management. When the growth is well established give the land a dressing of nitrate of soda. As the ground becomes available prepare it for winter crops of celery, leeks, broccoli, brussels sprouts, and savoy cabbage, and autumn crops of peas and beans.

Those cabbage-plants now in seed-beds are often troubled with insect pests during dry weather. This trouble is best combated by sturdy growth and ample watering. In difficult cases apply a spray consisting of 2 teaspoonfuls Black Leaf 40, 2 oz. arsenate of lead paste, and 4 gallons rain-water. Dilute the ingredients in a small quantity of water, and dissolve them well before pouring them into the bulk. Mix well and apply the spray in dull weather when the plants are dry, covering well the under-side of the foliage where most insects feed.

Celery is a waterside plant delighting in a rich soil. For this reason it is usually grown in trenches of rich soil, where it may be readily given abundant irrigation. Trenches for this purpose should now be prepared; usually they are made about 2 ft. wide to accommodate a double row of plants. Open the trench out 18 in. or so in depth, place a good layer of well-decayed manure in the bottom, mixing it well with about an equal quantity of soil, topping off with 3 in. or 4 in. of soil alone. This should then form a shallow trench of the stated width. Water the plants well before setting them out. Lift them with plenty of soil, disturbing the roots as little as possible, and put out plants of an even grade. After planting, water the trench, and do not let it dry out while the crop is growing.

The useful, mild, and hardy leek is in general esteem during winter. It should be planted out now, as soon as the plants are ready, into a good rich soil. It is customary to drop the plants into holes made 5 in. or 6 in. deep with a dibber, the tops of the leaves just showing above the top. Afterwards fill the holes with water, which will wash down sufficient soil to establish the plants.

TOBACCO.

In the tobacco-fields, as soon as the ground crusts or shows a growth of seedling weeds put the horse-hoes through the crop on a fine day, working the land to only a shallow depth. This treatment should maintain the necessary sturdy growth that is required. When the majority of the plants show flower-buds at the terminal the crop

should be topped—that is, the terminal bud removed by pinching it out. This act maintains that growth and vigour in the leaves which would otherwise be absorbed by the blossoms.

Preparations for the harvest and curing the crop should now be made. A supply of 4 ft. curing-sticks will be needed, and materials for rafters on which to hang them. Arrangements should be made to clear right out the sheds that are to be used, so that the most may be made of the usually limited space available. The ample but controlled ventilation required to properly carry out this operation is usually satisfactory as far as the lower portion of the building is concerned, but the upper portion under the roof is often far too close. To enable a free draught to be obtained there when necessary, ample ventilation should be put in the roof or gable ends.

—*W. C. Hyde, Horticulturist.*

THE CATTLE-TICK.

THE subject of ticks affecting cattle in the Dominion is dealt with in the annual report of the Live-stock Division for 1924–25 as follows:—

Auckland Stock District: While this pest has not shown much, if any, diminution in the districts known as A area, no apparent increase has taken place in B area, and on the whole fewer ticks were in evidence. In Matamata and Cambridge districts, where ticks were in previous years known to exist, no evidence of their presence was found during the past season. In all cases where ticks were found in B area, and on two farms immediately south of the boundary where ticks were reported, control methods were carried out with the willing co-operation of the settlers concerned. The control of the tick within the A area is a difficult proposition, owing to the conditions and the difficulty there would be in any attempt at weekly dipping or spraying of other than dairy cattle. Settlers in this area do a great deal of tick-destruction, but more individual and collective action is needed in order to effectively combat these parasites. Means additional to dipping and spraying are within the power of settlers, and, if practised systematically, would materially assist to reduce the pest. It is very noticeable that in open country where ground-cover is not afforded by long, coarse grass, rushes, &c., ticks are not present at all, or, if occasionally seen, do not increase. This applies also to the North Auckland area, while in the Waikato the tendency is to diminution.

Wellington Stock District: Unfortunately, the presence of ticks was reported from Waitara (Taranaki) in December last, having been found on a cow owned by a small settler there. Investigations were immediately instituted, with the result that ticks were found on other small properties, all in close proximity to the area where they were first discovered. A comprehensive examination of all stock within a radius of from two to three miles was made, with the result that a single tick was found on an animal distant about half a mile from the original outbreak, but it is satisfactory to record that, although a strict examination of stock has been carried out, no further ticks have been discovered. With a view to eradicating the ticks from the district, the small areas involved have been unstocked, and wherever possible all cover has been destroyed and burnt. An area embracing the Waitara Borough and surrounding properties has also been proclaimed a quarantine area within which the movements of all stock are controlled.

The indications are that these ticks are not likely to be troublesome outside those portions of the northern area where hot-weather and plenty of ground-cover conditions are suitable for them. Notwithstanding this, the restrictions against their spread are being thoroughly enforced.

Commercial Orchards.—The total area in commercial orchards in New Zealand is approximately 30,000 acres, of which about 75 per cent. consists of apples.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LAMENESS IN LAMBS AFTER DOCKING.

J. M. BARR, Jun., Makarau :—

We have had a good deal of trouble lately with lame lambs, the greater number of cases occurring after docking and among wether lambs. The lameness is not caused by foot-rot, but I have been told that it is some form of arthritis. I should be grateful for advice.

The Live-stock Division :—

We have observed instances of this trouble in lambs this season. The lameness is apparently not due to arthritis, as no evidence of enlarged joints was noted, and if arthritis were the cause it would certainly be detected by a swollen, painful condition of the joints, more particularly the hock, knee, and stifle. When arthritis is present in lambs very little can be done by way of cure; pain may be alleviated by gently rubbing the affected joint with belladonna liniment. Occurring after docking and castration, it is more probable that the stiffness or lameness is the result of microbial infection through the operation wounds, and this was undoubtedly the cause in the cases which came under our notice. Prevention lies in marking lambs on clean ground—avoiding operating in yards which are regularly used for the drafting of sheep. Strict attention should be paid to proper sterilization by boiling all instruments before use. Antiseptics should be freely used, and the swabbing of the operation wounds with disinfectant solution will ensure that no infection occurs.

PLANTING MUSHROOM-SPAWN.

"ST. ALBANS," Christchurch :—

I would be pleased if you could inform me how mushroom-spawn should be planted in a lawn—(1) time of season, (2) depth, (3) fertilizer or manure that would be most beneficial, (4) size spawn should be broken into.

The Horticulture Division :—

Mushroom-spawn is best planted in pasture about midsummer. The method is as follows: Remove a turf about 12 in. square and 3 in. deep, then 4 in. or 5 in. of soil, and in place of the soil tamp firmly some stable manure containing a piece of spawn about 3 in. by 2 in. Replace the turf and beat it firmly into place. The stable manure used should be fresh and in an even moist state of fermentation, such as that used for building a hot-bed.

GRUB ATTACKING RUSHES.

J. B. GUTHRIE, Ruahine :—

I am forwarding a few rush-stalks which contain grubs feeding on the core. Could you tell me what the grub is, and whether harmless or not? I became interested in it while burning off dead rushes in a valley on my farm, as I found them so generally infected, and am inclined to think the grub has accounted for the general dying-out of the bushes, making it possible for me to burn and clean up my pasture.

The Fields Division :—

The grub boring in the pith of the rushes is of common occurrence throughout New Zealand. It is the larva of a native moth named *Glyphipteryx iocheaera*. Some seasons the infestation is so prevalent that considerable areas of the host plant are killed above ground, and this certainly would assist burning. At times, however, the attacks are by no means so severe. This fluctuation is due to a hymenopterous parasite being more abundant some seasons than others.

MEAT SLAUGHTERING AND SELLING BY FARMERS.

"SETTLER," Upper Takaka :—

Please inform me if it is necessary that I should have a slaughtering license. I kill three sheep and a beast a week and sell to the neighbours.

The Live-stock Division :—

If your total weekly slaughterings are only three sheep and one cattle-beast there is no necessity for you to take out a slaughtering license, providing you are a *bona fide* farmer whose ordinary farming operations include the raising and fattening of stock, and that your farm is not situated inside or within three miles of a borough or town district, and that none of the meat from stock slaughtered by you is bartered or sold anywhere to a butcher, or anywhere inside or within three miles of a borough or town district. You are also required to keep a faithful record of all stock slaughtered and of the persons to whom they are bartered or sold, and to at all times have such record open to inspection by an Inspector. It is also necessary that all slaughtering of stock and handling of the meat be done under sanitary conditions. The Slaughtering and Inspection Act provides that every slaughtering-place, &c., shall at all times, to the satisfaction of the Inspector, be kept efficiently lighted, ventilated, cleansed, drained, and provided with a sufficient water-supply, and no offal, filth, or refuse is allowed to remain therein more than twenty-four hours. A *bona fide* farmer who can comply with these conditions is allowed to slaughter for barter or sale in any week stock not exceeding one head of cattle and five head of other stock.

ERADICATING TWITCH ON SMALL FARM.

"COUCH-GRASS," Appleby :—

Could you advise me as to the best way to clean ground of couch-grass ? It extends about 4 in. to 6 in. under the surface. The ground is good river-soil and easily worked.

The Fields Division :—

The particular type of twitch with which your land is infested is brown-top (*Agrostis tenuis*). This is a difficult grass to eradicate in your country. As your farm is a small one you will be unable to adopt the expensive method of summer fallowing. After the ground has been ploughed, use the cultivators and harrows alternately and repeatedly. If it suits your convenience some such smother-crop as oats and tares for cow-feed should then be sown. After each cultivation the creeping stems of the couch should be raked up and burnt. If you sow the paddock down next March with a permanent misture of good English grasses your practice should be to top-dress this pasture annually in May or June. After a year or two brown-top will begin to make its appearance in the winter. During the flush of the year and throughout the summer, in response to the winter top-dressing, English grasses will oust the brown-top.

FERN-ROOT AND BURNT BONES FOR PIGS.

J.M., Waiuku :—

Would you kindly inform me regarding the value of fern-root as a food for pigs, also that of burnt bones ?

The Live-stock Division :—

Fern-root is an excellent food for pigs, and gives the best results when fed in conjunction with dairy-products such as skim-milk, whey, or buttermilk. Green forages—rape, peas, clover, oats, and maize—may be given as a change from the fern-root. The exercise in rooting the fern is also very beneficial. Burnt bones have a value in feeding on account of their lime content. They should be ground up and fed with the liquid foods. Lime is necessary for body-construction and building up the frame, and should always be provided in some form.

DESTROYING CONVOLVULUS AMONG FRUIT-TREES.

"Woodlands," Dannevirke :—

Will you kindly advise me the best way to kill convolvulus which is growing thickly among fruit-trees? The ground is dug up every year, but in the spring comes up in a solid mass of convolvulus, which climbs the trees. The use of salt has been suggested, but I am afraid it may hurt the trees.

The Horticulture Division :—

The best method that can be advised is by no means an easy one. As your ground is dug over every year it would be advisable at that operation to pick out as much of the root as possible, and afterwards maintain a clean fallow, either by hoeing or, better still, by digging up the weed as soon as it commenced to make growth. In a very wet season or locality a smothering green crop, such as a thick sowing of peas, is a useful aid in accomplishing the task. As you suggest, strong chemical weed-killers could not be used without killing, or at least seriously damaging, the trees.

HARVESTING BROWN-TOP SEED.

F. Hutchinson, Tolaga Bay :—

I have some acres of brown-top which I propose harvesting this year. Not having had any experience in handling this crop, I would be obliged for any advice you could give me. The ground is too rough for machinery.

The Fields Division :—

It is extremely questionable whether it will pay you to harvest a small area of brown-top where machinery cannot be used. Farmers' dressed seed is not realizing a high price, and we should advise against cutting unless you intend using the seed yourself. The only method you could employ would be harvesting by sickle and flailing by hand.

CATTLE MARROWS AND PUMPKINS.

"Reader," Gisborne :—

Which do you consider has the best feeding-qualities, the cattle-marrow or the cattle-pumpkin? The marrow is the large variety, equally as big as cattle-pumpkin. Is there any danger in feeding marrows or pumpkins to cows in the winter-time prior to calving? I am saving the seed of the marrows, and as they were grown alongside the pumpkins I should like to know if they would be hybridized by the latter.

The Fields Division :—

It is considered that good-quality pumpkin, such as Ironbark, has a higher feeding-value than the marrow. It has been noted that where pumpkins and marrows have been growing in the same field, stock neglect the marrows until the pumpkins are all gone. So far as keeping-qualities are concerned, the marrow is not very good, whereas pumpkins can be used right through winter. Marrows mature more quickly, and for this reason can be grown where pumpkins would fail. So far as can be ascertained, there is no danger in feeding them to cows at any time. Where the two crops are grown close together there is a probability of cross-fertilization taking place.

PHOSPHATES OR BONEMEAL FOR COWS.

J. H. Sherrard, Otaua :—

Is the feeding of minerals to heavy-producing cows good practice? If so, what would you recommend? I have heard of bonemeal being used, but I hardly like to use it for fear of diseases.

The Live-stock Division :—

The supplementary feeding of minerals to cows should not be necessary if a properly balanced ration, and pasture on soil not deficient in essential elements,

are available. But, as it is well known that many soils are deficient in certain elements necessary for proper animal-nutrition—notably calcium phosphate—the replacement of this by feeding bonemeal, &c., becomes almost a necessity in conjunction with the proper manurial treatment of the soil. Feeding sterilized bonemeal can do no harm, and is most valuable when fed to cows some time before calving and for a month following. At this period the drain on the cow's system is considerable, and, if not replaced, will manifest itself in one way or another.

SELF-SOWN OAT CROP.

"HIGH COUNTRY," Moawhango :—

Immediately after stacking my oats last year I ploughed the stubble in, and have a fairly good crop of self-sown oats growing which I intend to leave. What manure do you advise me to top-dress it with? With last year's crops I sowed 2 cwt. of grain manure. Do you consider it a good plan to sow grass-seed at the same time as top-dressing, so that when the oats are cut the grass may come away?

The Fields Division :—

If the self-sown oats show signs of standing still it would be advisable to give them a dressing of some quick-acting manure—say, superphosphate—at the rate of 2 cwt. per acre. This should move them on and bring them to maturity with a better yield of fodder. With regard to the surface-sowing of grass-seed at the same time, this is not recommended, as the seed-bed would be very rough, and a great waste of seed would result.

TREATMENT FOR LICE ON PIGS.

S. G. KER, Thornton :—

Would you kindly let me know of a cheap and easily applied remedy for lice on pigs?

The Live-stock Division :—

Kerosene, one part, shaken up in two parts of linseed-oil, and applied to the skin with a brush, is very effectual in the destruction of lice on pigs. It should not be applied when the animals are exposed to sunshine. To effectually kill all eggs and lice which may develop from remaining eggs, it is essential to repeat the treatment three times at intervals of seven days. Sties must be thoroughly cleaned and sprayed with a strong solution of disinfectant, and afterwards lime-washed. All litter, &c., should be burnt.

STRAWBERRY, SUBTERRANEAN, AND SUCKLING CLOVERS.

"SETTLER," Raetihi :—

I should be glad to have any information about subterranean clover, suckling clover, and strawberry clover. Which are the most permanent and best for sowing on fern and manuka burns, or on bush burns on country likely to revert to fern and manuka? I find that subterranean clover is priced at about 7s. 6d. per pound, and suckling clover about 6d. per pound. I do not know the price of strawberry clover. Which would you recommend sowing on ploughed country (medium loam)?

The Fields Division :—

Strawberry clover is the most permanent clover of those you mention, and does well on low-lying land near the coast, but is hardly likely to be of much value in your district. Subterranean and suckling clovers are both annuals which reseed themselves each year, and consequently soon spread. Both are useful for sowing on fern and manuka burns in conjunction with other grasses. On such country about 1 lb. suckling clover and 4 oz. subterranean clover per acre may be suitably sown. For medium loam ploughable country it would be preferable to sow white clover and cow-grass—say, 1 lb. of the former and 2 lb. of the latter. The addition of 4 oz. subterranean clover and 8 oz. suckling clover would help, especially as stock grazing on it might carry some of the seed to the hills.

THE BRITISH MARKET FOR HOPS.

REPORTS received lately from the High Commissioner, London, indicate that the position on the British market, so far as New Zealand hops are concerned, is not favourable. The position at the termination of control, on 15th August last, is summed up in a note prepared by the Ministry of Agriculture (England), as follows :—

"At the termination of control the Hop Controller had in his bond approximately 20,000 cwt. of Dominion hops, of which about one-third would be New Zealand hops and the remaining two-thirds British Columbian. These were held in bond until the Controller's regulations (with regard to the disposal of the English crop, &c.) had been complied with, but, of course, they are now quite free.

"In addition to these Dominion hops there were also about 100,000 cwt. of foreign hops in the Controller's bond, and about 100,000 cwt. of English 1924 hops remained unsold. Brewers have been buying heavily this year, and are known to have considerable stocks of unused hops. It would probably be safe to say that there are enough hops in the country at the moment to supply brewing needs for about a year without counting the crop in the gardens which will be gathered this autumn.

"We do not think that in normal years the market here for Dominion hops is likely to be a very large one. The English brewer, we believe, is well content to use English hops for the bulk of his manufacture. A certain proportion of foreign hops is generally used, which until latterly might be taken as being about one-third of the total quantity used, or, say, 100,000 cwt. to 150,000 cwt. Generally speaking, what is sought are the somewhat stronger Pacific Slope hops or the better-quality Bohemian varieties.

"New Zealand hops coming to this country suffer disadvantages in two directions: they arrive at a time when the demand for hops is very slack, and the long journey through the tropics generally brings about a noticeable deterioration in their quality. These considerations lead us to think that the English market will never, so far as can be seen, absorb large quantities of New Zealand hops, while at the present time the market is so overstocked that further imports from New Zealand could hardly be expected to get a ready sale."

IMPORTATIONS OF FERTILIZERS: SEPTEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 30th September, 1925: *Sulphate of Ammonia :* From Australia, 535 tons. *Gypsum :* Australia, 1,402 tons. *Nitrate of Soda :* Australia, 35 tons; Chile, 25 tons. *Basic Slag :* United Kingdom, 3,623 tons; Belgium, 1,035 tons; France, 150 tons; Germany, 20 tons. *Bonedust :* India, 800 tons; Australia, 100 tons. *Phosphates :* New Caledonia, 1,901 tons; Seychelles, 4,331 tons; Nauru Island, 22,646 tons; United Kingdom, 20 tons; Egypt, 7,037 tons. *Kainit :* United Kingdom, 90 tons; Belgium, 55 tons; France, 348 tons; Germany, 155 tons. *Muriate of Potash :* France, 10 tons. *Sulphate of Potash :* United Kingdom, 15 tons; Belgium, 15 tons; France, 180 tons; Germany, 85 tons. *Potash, other :* United Kingdom, 45 tons; France, 495 tons; Germany, 220 tons. *Sulphate of Iron :* Australia, 21 tons.

Milk-sediment Testers.—During the past year new patent sediment-testers were supplied to all Inspectors of the Agriculture Department carrying out inspection of dairies in the chief centres, and these have been found of considerable value in their work.

Registration of Plant Nurseries.—During 1924–25 a total of 587 nurseries were registered and inspected by the Horticulture Division, which reports that nursery stock generally was found to be in good condition and comparatively free from disease. Registration fees collected amounted to £591 10s.

WEATHER RECORDS: OCTOBER, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

CONDITIONS during the first week of the month were in keeping with the weather experienced during the winter and the first month of spring; but, on the whole, October, which is regarded as the second month of the spring season, was a great improvement, and favourable to growth.

Westerly winds predominated, and five westerly disturbances were experienced, only one of which, however, was of much intensity. This storm passed in the south between the 13th and 15th, causing heavy winds and considerable rain, especially in the southern districts.

Anticyclonic conditions prevailed over the whole of the Dominion during the last week of the month, with fine sunny days and cold frosty nights, particularly about the 28th and 29th, when much tender growth was bitten by frost in several parts of the country.

Rainfall was below the average in most parts of the country, the exceptions being in the Nelson and Central Otago districts, which experienced from 20 to 90 per cent. above their average rainfalls. Most other parts of the country were below the average for October to the same extent.

—*D. C. Bates, Director.*

RAINFALL FOR OCTOBER, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	2·84	17	0·64	4·48
Russell	4·65	14	1·50	3·27
Whangarei	3·13	16	0·81	4·58
Auckland	2·03	19	0·31	3·63
Hamilton	3·35	22	0·48	4·82
Kawhia	3·54	18	0·44	5·28
New Plymouth	4·39	20	1·01	5·47
Riversdale, Inglewood	7·96	21	1·20	10·37
Whangamomona	6·00	20	1·08	9·11
Tairua, Thames	3·97	12	1·60	6·89
Tauranga	3·93	19	1·34	5·31
Maraehako Station, Opotiki	4·54	15	0·98	5·50
Gisborne	1·49	10	0·93	2·84
Taupo	2·31	15	0·86	4·28
Napier	1·17	10	0·54	2·50
Maraekakaho Station, Hastings	1·19	12	0·43	3·09
Taihape	2·57	13	0·39	4·30
Masterton	1·69	19	0·25	3·34
Patea	2·62	19	0·61	4·11
Wanganui	2·23	12	0·77	3·65
Foxton	0·67	7	0·18	3·03
Wellington	5·65	18	1·62	4·13
South Island.				
Westport	7·33	20	1·15	6·97
Greymouth	7·36	17	1·30	10·66
Hokitika	10·56	16	2·29	11·88
Arthur's Pass	14·59	13	4·50	20·99
Ross, Westland	13·47	13	2·58	15·16
Collingwood	12·54	21	2·94	11·03
Nelson	6·61	17	2·16	3·48
Spring Creek, Blenheim	2·67	14	0·70	2·39
Tophouse	6·87	18	0·82	5·80

RAINFALL FOR OCTOBER, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Hanmer Springs	2·50	15	0·44	2·66
Highfield, Waiau	1·44	8	0·42	2·46
Gore Bay	1·01	9	0·28	1·80
Christchurch	1·67	7	0·78	1·65
Timaru	0·90	11	0·26	1·97
Benmore Station, Omarama	1·72	9	0·40	2·09
Lambrook Station, Fairlie	1·74	10	0·70	2·00
Oamaru	1·24	8	0·37	1·66
Queenstown	3·48	12	0·97	3·60
Clyde	2·70	8	1·70	1·58
Dunedin	2·22	13	0·58	3·03
Wendon	3·10	9	1·23	2·50
Invercargill	3·24	14	0·86	4·57

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 24th September to 5th November, 1925, include the following of agricultural interest:—

No. 52715: Milk-agitator; C. B. Dent, Christchurch. No. 54048: Animal-trap; B. P. Priest and others, Kinver, England. No. 54223: Milking-machine teat-cup; B. D. Holmwood, Masterton. No. 54302: Sheep-shearing-machine comb; F. G. W. Bristow, Sydney, N.S.W. No. 54492: Fruit-picking device; T. R. W. Wright, Christchurch. No. 52376: Milking-machine; S. J. Avery, Sanson. No. 53081: Animal-controller; P. T. Fromm, Walton. No. 54088: Churn; J. O'Connell and H. H. Kerr, Kensington, Vic. No. 54224: Milking-machine vacuum-control device; B. D. Holmwood, Masterton. No. 52090: Milk sampling and weighing apparatus; J. J. Raynes, Rukuhia. No. 52666: Fencing-post; H. W. and L. A. James, Waipawa. No. 52924: Plough-spring coulter-clamp; H. E. Thew, Timaru. No. 54175: Milking-machine teat-cup; R. McIntyre, Palmerston North. No. 54180: Harrow; P. and D. Duncan, Ltd., Christchurch. No. 54617: Pig-house; A. J. Palmer, Palmerston North. No. 54633: Animal dry feeder; A. J. Palmer, Palmerston North. No. 54662: Agricultural-implement forecarriage support; M. J. Hooper, Auckland. No. 52395: Lime and fertilizer distributor; J. A. Storrie and J. W. Willett, Invercargill. No. 52932: Plough-lifting means: J. I. Carter, Waipawa. No. 53029: Plough; P. and D. Duncan, Ltd., Christchurch. No. 53895: Weed-destroyer; W. F. Stewart, Tamahere. No. 54235: Animal-trap; H. L. Mainland, Dunedin. No. 54743: Milk-can; H. Meister, Sydney, N.S.W. No. 54762: Wire-bound box; R. P. Park, Melbourne.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price, 1s.

Destruction of Wild Pigs.—The State Forest Service *Newsletter* for September states: "During the lambing season the stream of claims for payment of royalty on wild pigs killed has been heavy and continuous. We are now operating over the whole of Taranaki, the Wanganui River locality, and the Ruatiti-Raetihi locality, between the Main Trunk line and the Wanganui River. Some twenty prominent settlers in convenient locations act as collectors of snouts on behalf of the Service, and are periodically visited by the district Forest Ranger.

THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

FROM information furnished by the Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 85·64 per cent. With 7,463,735 breeding-ewes in the North Island, as shown in the 1925 sheep returns, the number of lambs is estimated at 6,391,812. South Island and Dominion estimates will appear in next month's issue.

ESTIMATED AREAS UNDER WHEAT AND OATS.

THE following estimates of the areas under wheat and oats in the Dominion for the current season have been issued by the Government Statistician at date 27th October, the figures being based on the usual card census: Wheat—North Island, 2,600 acres; South Island 157,400 acres: total 160,000 acres. Oats—North Island, 35,000 acres; South Island, 350,000 acres: total, 385,000 acres. The corresponding final totals for the previous season (1924–25) were 169,094 acres of wheat and 472,315 acres of oats. In the current season's wheat-sowings the areas under the different varieties are given as follows: Tuscan or longberry, 116,247 acres; Hunter's (various), 21,467 acres; Velvet or Pearl, 8,043 acres; balance unspecified.

FORTHCOMING AGRICULTURAL SHOWS.

Thames Valley A., P., and H. Association: Te Aroha, 24th and 25th November.
Stratford A. and P. Association: Stratford, 25th and 26th November.
North Otago A. and P. Association: Oamaru, 26th and 27th November.
Wyndham A. and P. Society: Wyndham, 4th December.
Auckland A. and P. Association: Auckland, 4th and 5th December.
Waipukurau A. and P. Association: Waipukurau, 22nd January, 1926.
Horowhenua A. and P. Association: Levin, 26th and 27th January.
Rodney Agricultural Society: Warkworth, 6th February.
Dannevirke A. and P. Association: Dannevirke, 10th and 11th February.
Pahiatua A. and P. Association: Pahiatua, 13th February.
Masterton A. and P. Association: Solway, 16th and 17th February.
Taumarunui A. and P. Association: Taumarunui, 17th February.
King-country Central A. and P. Association: Te Kuiti, 18th February.
Northern Wairoa A. and P. Association: Mititai, 20th February.
Tauranga A. and P. Association: Tauranga, 26th February.
Franklin A. and P. Association: Pukekohe, 26th and 27th February.
Omaha and Pakiri A. and H. Association: Leigh, 27th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 3rd and 4th March.
Mayfield A. and P. Association: Mayfield, 20th March.
Temuka and Geraldine A. and P. Association: Winchester, 25th March.
Methven A. and P. Association: Methven, 27th March.

Agricultural and Pastoral Association Secretaries are invited to supply dates and location of their shows for publication in the "Journal."

Area under Potatoes.—The Government Statistician estimates the area under potatoes this season (1925–26) as 5,000 acres in the North Island and 17,500 acres in the South Island, or a total of 22,500 acres. The corresponding final figures for the 1924–25 season were 5,214, 17,878, and 23,092 acres respectively. Only holdings of 1 acre and over outside borough boundaries are covered by these figures. A fair aggregate area of potatoes is grown on the smaller holdings and within boroughs.

The New Zealand

Journal of Agriculture.

Vol. XXXI.—No. 6.

WELLINGTON, 21st DECEMBER, 1925.

MINERAL ELEMENTS IN THE FEEDING OF STOCK.

THEIR VITAL IMPORTANCE.

B. C. Aston, F.N.Z.Inst., Chemist to the Department of Agriculture.

1. INTRODUCTION.

Starvation is the rarest of deaths, but the commonest of ailments. The term "starvation" must not be limited to denote only a result caused by a lack of one kind of food, but must equally well be applied to the want of any essential kind of food—whether of a type such as the proteins, carbohydrates, and fats, consisting of the elements carbon, hydrogen, oxygen, sulphur, and nitrogen, the so-called organic elements, which supply the animal with warmth and energy and which constitute by far the greater bulk of the foodstuff; or of those other inorganic or mineral elements such as calcium, phosphorus, potassium, sodium, magnesium, iron, and chlorine, which provide material to form the bony skeleton and the blood, and have also the less obvious but more essential duty of providing the machinery for the chemical and physical processes which take place during life, and necessary for the beating of the heart, respiration, the working of the nervous system, for digestion and excretion, and t[illegible] proper functioning of every organ of the animal body.

When an animal bo[illegible] is burnt in air the organic constituents are oxidized and disappear as gases, leaving an ash which contains for the most part the necessary mineral elements or inorganic food;

and the first step of the chemist to determine the amount of mineral food in any form of life is to reduce it to an ash free from carbon and the other combustible elements. In addition to the mineral elements present in the greatest amount in the ash, there are others present only in traces in the body of the animal, and which may be just as necessary to its life and health. These are iodine, manganese, fluorine, copper, zinc, arsenic, and possibly others.

Starvation due to the deficiency of any of the essential mineral elements may be specially indicated to distinguish it from that of the ordinary kind. Thus the term "calcium starvation" is used to denote cases where there is a deficiency of lime salts in the food-supply, resulting in malnutrition of the bones, or rickets; "iron starvation," to distinguish a want of iron in the food, leading to progressive anæmia; and "iodine starvation," to lack of iodine, leading to the development of simple goitre. The thought naturally arises, If lack of each of these elements gives rise to such definite and unmistakable symptoms, cannot lack of any other element when such a condition occurs be predicted from a knowledge of the symptoms? Such diagnosis is at present not attainable in our limited state of knowledge.

It used to be a source of wonder to many why it should be so much more difficult to keep some hundreds of fowls healthy than, say, a dozen. A small number of hens scratching round a homestead were never any trouble, and apparently nothing could be healthier; but let the amateur attempt to keep a few hundreds, and unless a study of rations and proper provision for all mineral foods is made disease will appear. It is the same with pigs; the "gentleman that pays the rent" and lives with the family, and picks up all the minerals it requires, thrives with very little attention; a dozen pigs in pens, however, would require not only energy foods but a nicely assorted mineral ration to enable them to put on the customary profit at the quickest rate.

It is noteworthy that deaths from actual starvation of any kind in human beings are so rare. It is recognized that even in the poorest communities the danger of improper feeding lies not so much in death from starvation, but in the lowered vitality caused by malnutrition leading to lack of resistance to other ills that flesh is heir to. This idea, which is accepted and acted upon by those charged with the rearing of children, is not so prominently realized by those who have the care of our domestic stock. The penalty of under-nourishment of stock through lack of the proper mineral foods in proper balance is not death from starvation, but from disease of all kinds, which spreads quickly through the flocks and herds and gains a rapid victory over the enfeebled host.

The pressing importance of the mineral elements in New Zealand agriculture is likely to be demonstrated in two classes: (1) Where the soil is deficient in or unable to yield to the pasture that amount of plant-food which the animal requires; and (2) where the animal is artificially fed. One may consider for the purpose of this article that all the New Zealand pastures, whether natural or induced, are the natural food of the domestic herbivoræ. When animals grazed on a New Zealand pasture of any kind do not thrive, and their condition is not referable to any communicable disease or to poison, their condition is due to starvation caused by a deficiency in the food available; either the quantity or the quality is at fault. When the quality is wrong the animals are probably suffering from some form of mineral deficiency.

An animal grazing on good mixed pasture will select its food to include all the elements required and so balance its own ration; little is here required with the exception of salt as a lick. In the case of stall or artificially fed animals the difficulties of giving the best balanced ration are very greatly increased, as the animal cannot correct an erroneous ration. It has no choice, and cannot be guided by palatableness, which would operate under more natural conditions. Hence the greatest advance which can immediately be made in the improvement of the feeding of domestic stock in New Zealand will probably be made in the case of pigs and poultry. It is exactly in these cases that so much progress in animal-nutrition research has been made in older countries, and it will be much more so in New Zealand, where the stall feeding and artificial feeding of ruminants are not generally practised, thanks to the long growing-period of the pasture.

There are, however, some extensive areas of land in the North Island, the porous, non-retentive soils of which cannot possibly be called normal, but on which, nevertheless, the ordinary pasture plants are able to grow owing to the good rainfall. Such plants in the droughty season of the year may not contain the requisite mineral ration for the animal. If grazed on such lands the animal is likely to suffer from mineral starvation, in spite of the seeming abundance of food; and following starvation is the consequent lessened resistance to disease. The plant is able to take up from the soil when the conditions are favourable very much more mineral food than is actually required, and it is probably this fact which enables ruminant stock to be grazed solely, continuously, and successfully on the richer pastures of the North Island and on those which are heavily top-dressed. One can therefore predict in pen-fed animals and in ruminants pastured on deficient soils an immediate and profitable response to any attempt to improve the mineral feeding, whether supplied directly to the animal by medicine, lick, or ration, or indirectly by top-dressing the pasture, and that such response will show itself not only by increased and quicker profits but in the improved health of the stock as shown by freedom from communicable disease.

It has been proved by experiment that an animal will die sooner on a diet which is entirely deficient in mineral matter than another animal which is given no food at all. This fact alone is sufficient to demonstrate the necessity of mineral food and the importance of ensuring an adequate supply of it. Further, an animal from which all food is withheld dies a peaceful and comparatively painless death, but an animal from which mineral food is withheld suffers from disturbances of the digestive system, convulsions, and other distressing symptoms.

At the outset of an inquiry of this kind one is met with the great lack of knowledge on just those points upon which accurate information is desired. The exact requirements of every domestic animal for every kind of mineral food are not even approximately known. With some elements we must therefore endeavour to present them in such form that the animal may select what it requires and so obtain a properly balanced ration. Pasture must be mixed—not too much grass on the one hand, nor clover on the other. A pasture consisting wholly of clover is bad. Where pasture is deficient in phosphates or calcium these must be supplied as top-dressing. The first indication

of this deficiency may be the appearance of "Waihi" disease, or some form of malnutrition of the bones.

In artificially fed animals these mineral nutrients are best fed as ground sterilized bonemeal. Lime, magnesia, and phosphoric acid are the compounds of which bone is composed, but it must not be supposed that the only function of bone is to provide a framework upon which the animal is built. Bone, in addition, is the repository of those compounds which are held, as money is in a bank, ready to be withdrawn for use by the animal when needed. To such an extent is this done when the animal needs lime and phosphate, and when the food is deficient in these mineral foods, that the bones become brittle, the joints sore and swollen, and a condition known as osteomalacia results. This condition is relieved at once by giving the animal a medicine containing the deficient foods only, and top-dressing the pasture with quick-acting phosphates, provided there is sufficient soil-moisture to carry the phosphate to the plant-roots. The condition occurs in many parts of the North Island, especially in droughty seasons, on land deficient in phosphates. Here, then, is a case in which the pasture is getting all the phosphates it requires to keep it alive, but that amount is not enough for the animal. Osteomalacia in cattle may sometimes be relieved by feeding steamed bonedust. In South African cases even unground bones have been given, these being greedily devoured. Ground mineral phosphate is considered to be not efficacious, so that evidently all forms of phosphate are not similarly curative.

A growing pig's daily ration should contain $\frac{1}{2}$ oz. lime, and that of a calf about 1 oz. The lactating cow requires to consume and assimilate a large quantity of mineral foods. A gallon of cow's milk contains, roughly, $\frac{1}{4}$ oz. of lime, $\frac{1}{3}$ oz. phosphoric acid, and $\frac{1}{6}$ oz. chlorine, and these are the three minerals most likely to be deficient in the food. But, as only half these quantities in the food are capable of being assimilated by the animal, double the amounts (or treble according to another authority) must be present.

The foregoing instances will show that the mineral elements are not the small, negligible factor in the feeding of farm-stock which many may suppose. Every farmer should know the importance of giving salt to his stock. Salt is sodium chloride, and commercial rock salt also contains a small amount of iodine. Salt is especially necessary to supply chlorine in the making of hydrochloric acid for the digestive juices, and it will be seen from the figures quoted that milk contains a comparatively large quantity of chlorine, so that salt is highly necessary for milch cows. An excessive amount of salt taken induces too great a thirst and consequent dilution of the gastric juices by the undue amount of water drunk by the animal.

Iron is a very important element, as the blood corpuscles contain it in quantity. A deficiency of iron compounds in the food causes anæmia, a condition which may be relieved by appropriate iron medicines, or by improving the pasture in the same way as calcium and phosphate deficiency is relieved, but using a phosphate containing iron. Different classes of animals are able to assimilate iron in different forms. Thus a pig can assimilate iron found as oxide in the earth or rocks or cinders. Cattle, on the other hand, appear to require it, when it is administered medicinally, in a form in which it is given to human beings—namely, as an organic salt such as the double citrate of iron

and ammonium. The most effective form of all, however, is the natural one contained in normal pasture.

It is important to notice that the fact of deficiency of mineral foods taking some time to show themselves in the animal is owing to the storage of these elements in the bones and liver. Another important fact to remember is that different classes of animals have a different requirement for food according to their rate of growth. Consequently, on a given pasture which is deficient in mineral food a rabbit would become sick first, then a sheep, next a cow, and last of all a horse. That is why malnutrition diseases are rare in the horse and so common in the sheep.

To show that this mineral feeding has an immediate and practicable side, some experiments with poultry at the Rowett Research Institute in Animal Nutrition, Aberdeen, may be quoted. Twenty-eight Leghorn pullets, with free access to oyster-shell and flint grit, and an adequate diet of wheat, maize, oats, and bran mash, were divided into two and given the following mixture: Steamed bone-flour, 100 parts; calcium carbonate, 40; salt, 40; sulphur, 10; oxide of iron, 10; potassic iodide, 1. This mixture was added to the mash in the proportion of one part to twenty of mash. The experiment was continued for a year. The result was that the average number of eggs per bird in the pen without added minerals was 107·4, while the birds which received added minerals laid an average of 178 eggs. In another experiment, lasting seven months, the birds without added minerals averaged 61·22 eggs, and those supplied with minerals 83·66 eggs. In a third experiment, lasting five months, the birds without minerals averaged 53·6 eggs, and those with minerals 67 eggs.

The conclusion of practical importance would seem to be that an addition to the mash of a mineral mixture such as that specified, or some food such as fish-meal, which contains a very large proportion of mineral matter, will lead to increased egg-production even when the poultry have plenty of green food and shell-grit and an outside run. (See *Scottish Journal of Agriculture*, July, 1925, p. 263.)

In an experiment with pigs the mineral elements were proved to be highly beneficial. Two groups of pigs were given a ration consisting of grains and grain offal, which contained 4·56 grams of phosphorus pentoxide (P_2O_5), but only 0·47 gram of lime (CaO). One group had in addition access to chalk, bonemeal, rock salt, and coal ashes. The results (as recorded in the *Scottish Journal of Agriculture* for July, 1922) were as follows:—

	Initial Weight. lb.	Weight after 124 Days. lb.	Gain. lb.
Ration only	32·1	101·4	69·3
Ration and added minerals ..	31·5	164·3	132·8

An excess of some mineral foods may prove harmful; therefore it is necessary in artifically fed animals to study the proper balance of the rations provided.

For much of the information to be presented in this article the writer is indebted to Dr. J. B. Orr, Director of the Rowett Institute, which was recently visited by the writer.

(To be continued.)

CHEWINGS FESCUE.

HISTORY, SEED-PRODUCTION, AND SEED-EXPORT PROBLEMS.

NELSON R. FOY, Seed Analyst, Biological Laboratory, Wellington.

CHEWINGS FESCUE is now comparatively unfamiliar to New Zealand agriculture, except in the district to which its seed-production is practically confined. Yet in the United States and Canada it is probably the best known of all the grass and clover seeds exported from this Dominion. Some years back Chewings fescue held a place in North Island pasture mixtures, but it has gradually given way to brown-top and Danthonia pilosa. As a fine-leaved lawn-grass, however, it ranks high. The great bulk of the New Zealand output of seed is exported, mainly to North America, for the turfing of golf-greens, bowling-greens, and various types of lawns. It is also a constituent of most lawn mixtures retailed in New Zealand.

The following notes are presented with two objects in view: firstly, of giving buyers and consumers of seed in New Zealand and abroad some idea as to where and how the seed is produced; and, secondly, to put before growers and commercial seed-houses the results of several experiments conducted in connection with the losses in vitality of the seed after shipment from the Dominion.

CLASSIFICATION.

Botanically, Chewings fescue is a variety of *Festuca rubra* L., and is described as *F. rubra* var. *fallax* Hackel, the essential difference between it and red fescue (*Festuca rubra* var. *genuina* Hackel) being the creeping habit of *F. rubra* var. *genuina* and the tufted, compact growth of *F. rubra* var. *fallax*. It is believed by many that Chewings fescue is the outcome of environmental changes subsequent to the introduction into New Zealand of the parent species. This is not so, as the variety is well known in Europe, especially in Germany, and the two descriptive common names "creeping red fescue" and "tufted red fescue" (Chewings) are assigned to them. Wittmack, in reference to tufted red fescue, says, "The seed is collected wild, partly in middle Germany, often mixed with sheep's fescue, but most comes from New Zealand. Unfortunately, this is only the tuft-forming variety."

The seeds of the two species are to all appearances identical, but, according to Stebler and Volkart, there are slight differences in the proportionate lengths and widths, length of awn, and weight per thousand, Chewings being the lighter of the two.

HISTORICAL.

Southland is the home of Chewings fescue in New Zealand, and it is there dominant over a large tract of poorer-class country. The authentic account of its introduction into Southland* rather confuses

* For these particulars the writer is indebted to Mr. G. Stevens, of Messrs. J. E. Watson and Co. (Limited), Invercargill.

the theory as to its origin, for, according to this, the original seed, the parent of all the fescue covering the present areas, was hard fescue (*Festuca ovina duriuscula* Koch), a form of sheep's fescue (*F. ovina* L.). According to the account, the original seed was supplied as hard fescue by a well-known firm of English seedsmen, and was sown about eleven miles out from Invercargill. Two years later the pasture was cut for seed, and was taken by a Mr. Tarlton and sown at Mossburn. This Mossburn property was later purchased by a Mr. Chewings, who harvested the fescue-field and marketed the seed, presumably as "Chewings's fescue." This would be about the year 1885. As all the present fescue areas of Southland originated from this one line of seed, it would appear that Chewings fescue is a variety

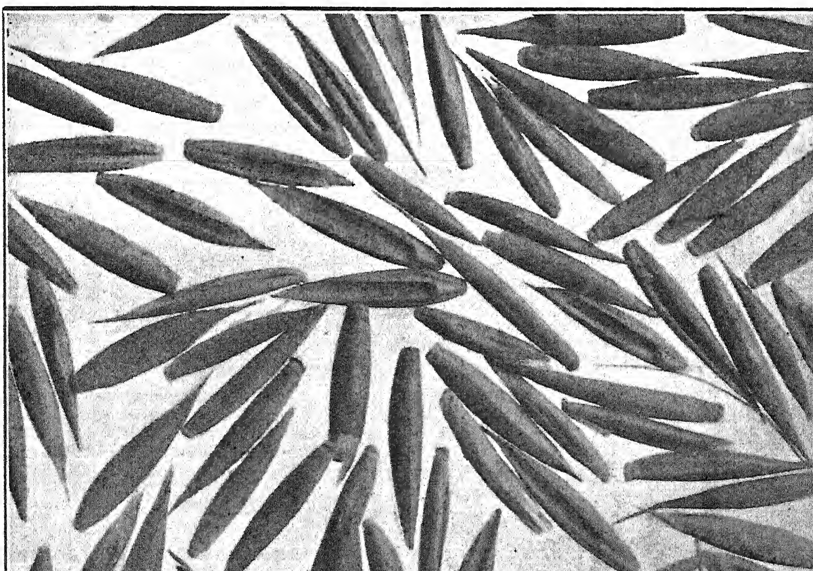


FIG. 1. SEED OF CHEWINGS FESCUE. MAGNIFIED 6 DIAMETERS.

[*Photo by E. Bruce Levy.*

of *F. duriuscula* and not *F. rubra;* but, as botanical classifications of the plant place it indisputably as a variety of red fescue, it can only be assumed that an error was made in the original shipment, and that European red fescue (apparently the tufted form) was supplied instead of the hard fescue as specified.

SEED-PRODUCTION.

The main seed-producing area of Southland is the tract of country extending from Mossburn to Lumsden, Balfour, Riversdale, and Otama.

Total acreages and yields since 1915–16 (taken from the "New Zealand Official Year-book," 1925) are as follows :—

Season.	Acreage.	Yield. lb.	Average Yield per Acre. lb.
1915–16	5,787	1,230,219	212·5
1916–17	5,514	1,247,545	226·0
1917–18	4,372	1,013,042	232·0
1918–19	2,329	551,588	236·8
1919–20	3,425	827,769	241·0
1920–21	3,469	680,116	196·0
1921–22	6,231	1,650,327	264·8
1922–23	6,423	2,334,386	361·9
1924–25	9,279	1,499,177	161·5

These yields will be in undressed seed off the mill. The total amounts of dressed seed available for commercial purposes will, of course, be less—say, 20 per cent.—due to dressing losses. The high and low yields for the 1923 and 1924 seasons respectively should be noted.

This seed plays an important part in the prosperity of the fescue country in Southland, in that it is peculiarly adaptable to the soil and climate; and, while it provides a certain amount of palatable sheep-grazing, the return from it as a seed crop in many cases makes the local farming an economic proposition.

The seed is sown with a rye-grass and clover mixture (mainly perennial rye-grass), and occasionally with an oat cover. Pure sowings are sometimes made, but advantage is usually taken of the early grazing provided by the rye-grass and clover, which in two years goes out, leaving the fescue in possession. In the early part of the third year a seed crop is taken off, and this is followed by alternate grazing and seed crop for two or four years. These crops are known as first, second, and third cuts, the quality and yield of the seed decreasing with the age of the pasture. The turf is now generally quite sod-bound and unproductive, and may be turned in with a deep furrow and the rotation —oats, turnips, &c.—proceeded with, or may be renovated by skim-ploughing. This consists merely of the turning of a 7 in. or 8 in. furrow to a depth of 4 in., and setting it well up. The ploughed ground is left untouched, and the fescue reappears between the furrows. In due course two successive cuts are taken off. In the normal sequence this concludes the long fescue phase of the rotation, but it is not unusual to find a further renovation being undertaken for additional seed crops. This latter practice cannot be recommended, as it stands to reason that a pasture exhausted by continual cropping will consist of plants incapable of producing a heavy-weight seed of high vitality.

The crop is cut with the reaper-and-binder, the stripper being used only where a stand is thin. Unlike many other grasses, Chewings fescue ripens very evenly, and it is generally recognized that there is a margin of three or four days in which the crop may safely be cut. The frequent high winds on the Waimea Plains are a source of danger, as the fully ripe seed is very loose and quickly falls. The inclination of the grower, therefore, is to be on the safe side and to cut well before ripening is completed. Reference will be made to this point later.

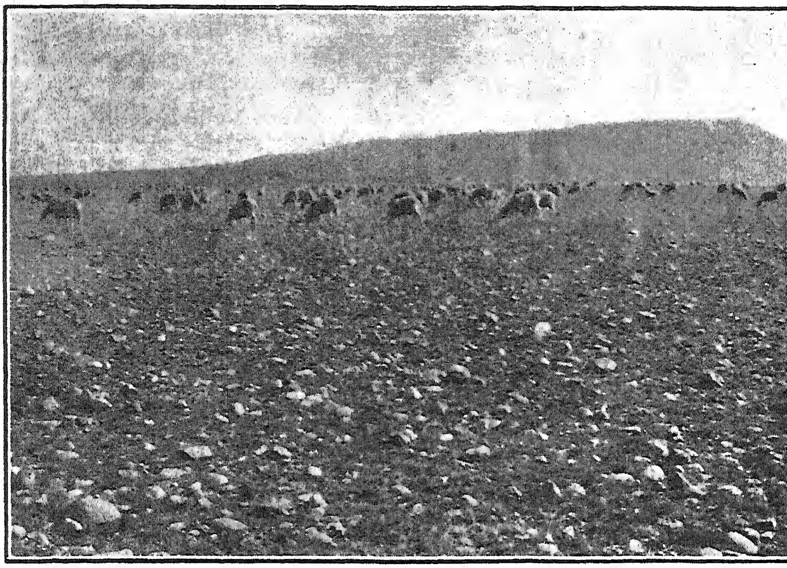


FIG. 2. TYPICAL COUNTRY IN THE MOSSBURN DISTRICT.

Chewings fescue is here replacing the original pasture of rye-grass and clover.

FIG. 2. CHEWINGS FESCUE COMING UP IN THE FURROWS AFTER PLOUGHING FOR RENOVATION.

[*Photos by E. Bruce Levy.*

Threshing out of the stook is almost general. The time the crop is left in stook is governed to a large extent by the availability of the threshing-mill, but is usually not less than two weeks. Very occasionally the crop is stacked for six or eight weeks. Threshing out of stook is naturally more popular, for the reason that the grower completes the whole of his harvesting operations in a few weeks, and is able to dispose of his seed much earlier.

The seed comes off the mill weighing about 13–14 lb. per bushel. In this rough state it necessarily contains a high percentage of chaff and seed impurities, the quantity being dependent to a large extent on the age of the crop. A good average weight per sack is 70 lb., and an average yield is from four to five sacks per acre. A grower may sell on the spot on an undressed sample, or may have the seed cleaned and sell on a machine-dressed sample. Unlike cocksfoot, the buying of which is done on bushel-weight, Chewings fescue is bought for the most part on a germination test.

It will be seen from the foregoing that Chewings fescue seed-growing cannot be looked upon as an additional catch-crop, but that it is a primary feature of farming practice on this type of country in the district.

The bulk of the seed is dressed in large cleaning plants at Gore and Invercargill, where it is machined to its "natural weight," which varies from 20 lb. to 28 lb. per bushel, averaging 24–25 lb. The export trade is controlled from the two centres mentioned, and from Dunedin and Wellington. As previously stated, the bulk of the seed is shipped to North America, the United States absorbing on an average about 350 tons per annum.

GERMINATION PROBLEMS.

Machine-dressed fescue is practically always of a high standard of germination and purity. The figures computed at the official seed-testing station show the average germination to be 86 per cent., but it must be remembered that this figure covers average growths of all classes of seed. It can safely be said that good average new crop Chewings fescue may be expected to grow 90 per cent. or over (empty glumes, if any, included in this test).

While Chewings fescue is a fairly vigorous and a high-germinating seed, like most other fescues it does not retain its vitality for any great length of time. There are some exceptions, but as a rule the growth of Chewings does not hold much after eighteen months from time of harvest, and at two years the seed is practically inert. It is to be expected, therefore, that such a short-lived seed is extremely delicate and is very susceptible to adverse storage conditions, the degree of susceptibility being directly associated with vitality. This character of the seed is responsible for the serious losses in germination which occur subsequent to shipment from New Zealand. As a result of this feature many promising export markets have been lost, and during many years the existing trading has been carried on under difficulties and uncertainties.

Briefly, the position may be reviewed as follows: (1.) The American demand has always been the heaviest, but during the last few years has shown a gradual decrease until the present season, when practically

the whole of the light 1925 crop, together with the carry-over from 1924, was purchased by North America. Considering the existence of the general dissatisfaction of American importers with many previous deliveries, and the fact that the use of Chewings fescue is condemned by several American agronomists, it is most difficult to satisfactorily account for this demand for seed of any quality. Although it is not probable, it is hoped that the same demand will continue. (2.) Britain is a willing buyer, but, under the present uncertainty of the growth of seed shipped, imports very little. It is known definitely that, could satisfactory deliveries be made, Britain and the Continent of Europe could absorb up to three times the present output of Southland. (3.) A proportion of export lines of high germination capacity when shipped arrive at their destination without serious loss. (4.) A proportion of export lines arrive at their destinations with losses ranging from 10 per cent. to 80 per cent.

Various theories have been advanced to account for this deterioration in vitality. They may be briefly stated as follows, each being followed by comments in brackets :—

(*a.*) Chewings fescue is a short-lived seed, and cannot be expected to retain its vitality during shipment overseas. [Storage experiments have shown that good average seed will store from eighteen months to two years.]

(*b.*) High temperatures experienced while crossing the tropics have a bad effect. [Frequently two different lines of high germination have been shipped on the one steamer, one arriving with a high growth, the other with a low one.]

(*c.*) Bad effects of machine-cleaning—that the seed is frequently too severely hummelled. [The seed-testing station has stored samples of dressed and undressed seed of the same lines, and in every case the rate of decline in growth was the same.]

(*d.*) The existence of parasitic fungous growth on the seed, which destroys the germ. [This theory was advanced in England, but later abandoned.]

(*e.*) Effects of steamer stowage—different holds and associated cargoes. [In experimental shipments sacks of seeds have been placed as near as possible to the boilers, but showed no harmful effects. Stowage of seed with wool-bales would be harmful.]

(*f.*) Seed from first-cut maiden pasture or first-cut regenerated fields should alone be saved. [It is generally recognized that the first cuts yield the best-quality seed, but a single cut would not pay the grower.]

(*g.*) Chewings fescue has "gone back"—that is, through repeated sowings of seed from the same areas the plants have less vigorous growth and bear seeds of low vitality. [This is a popular theory, but the matter of inter-hybridization cannot be discussed here. There is no doubt that a great variation in plant-type exists, but whether seeds from the various types differ in vitality has not yet been ascertained.]

(*h.*) Fertilizer top-dressing is required. [It is reasonable to suppose that the replacement of elements removed year after year would have beneficial results both in regard to grazing and seeding.]

(*i.*) The existence on the seed-stalk of a brown stain caused by the fungus *Helminthosporium sativum*. [This is very common in

Southland, especially on the older growths, and is said to have been observed for the last twenty years. Although there is nothing definite on the point, it is certain to have a weakening effect on the seed through the prevention of a free flow of sap to the seed-head. The fact that it is present mainly on weakened growths strengthens the argument in favour of top-dressing.]

(*j.*) Effects on seed-maturity of early cutting and threshing too soon after cutting. [There is no doubt that much of the seed harvested in Southland is cut too early, before the final maturation processes have commenced. These processes commence when the seed is at the stage known as "ripe," but not "dead-ripe." This is when cutting should take place, the final maturing being allowed to take place in the straw. This takes some weeks, and is usually prevented by stook-threshing.]

DEPARTMENTAL EXPERIMENTS.

These have not been as extensive as one would desire. They have furnished, however, an amount of valuable data on the behaviour of the seed, and have given an indication as to which of the above-stated factors are responsible for the shipment troubles.

Series No. 1.

This series was commenced in 1920 in co-operation with the United States Department of Agriculture, Washington. A tabulation of the results is shown in Table 1.

Procedure: Of twelve sacks of a single line of high-grade seed, one was shipped to Washington via San Francisco every alternate month for a period of two years. Tests were made on each sack at time of shipment and again on arrival in Washington. There each sack was stored under good conditions and a test sample drawn every alternate month.

Table 1.—Showing the Results of No. 1 Series of Experiments.

The figures in bold type give the germination when the sack left New Zealand. The difference between the bold figure and the next in the same line gives the fall during transport from Wellington to Washington. Reading the bold figures down on the angles gives the fall in germination during storage in New Zealand. Reading horizontally gives the test results of each individual sack during storage in the United States. Reading vertically gives the state of vitality of each sack after shipment in the month indicated.

Sack No.	1920.					1921.						1922.	
	April. %	June. %	Aug. %	Oct. %	Dec. %	Feb. %	April. %	June. %	Aug. %	Oct. %	Dec. %	Feb. %	April. %
1 ..	**95**	80	69	30	28	30	29	18	11	7	5	4	4
2 ..	..	**89**	87	77	71	53	49	50	30	24	23	17	14
3 ..	..	..	**87**	82	80	79	77	57	36	27	24	23	28
4 ..	..	..	..	**89**	..	(Lost in transit.)							
5 ..	..	..	..	..	**85**	83	68	58	29	19	22	18	20
6 ..	..	..	..	..	..	**86**	74	..	..	26	21	..	17
7 ..	..	..	..	..	..	..	**71**	38	6	4	5	1	1
8 ..	..	..	..	..	..	..	..	**73**	18	3	2	3	1
9 ..	..	..	..	..	..	..	..	..	**63**	13	10	11	2
10 ..	..	..	..	..	..	..	..	..	..	**55**	23	12	8
11 ..	..	..	..	..	..	..	..	..	..	..	**41**	20	6
12 ..	..	..	..	..	..	..	..	..	..	..	..	**18**	17

NOTE.—Sacks Nos. 6 and 7 stowed forward in No. 1 hold; remainder in No. 2 hold just forward of the bridge.

Results: This series furnished very little information other than that Chewings fescue could lose its vitality in a remarkably short space of time. For the twelve months after harvesting (up to sack No. 6) no serious fall took place during transit, but the fall subsequent to arrival was extremely rapid. Thereafter the decline during both transit and storage was very marked. It has been suggested that Continental rail transport from San Francisco to Washington may have had harmful effect, and that in the first test made the injury would not be evident.

Series No. 2.

This was commenced in 1923 in co-operation with Messrs. Sutton and Sons, Reading, England. The results are shown in Table 2.

Procedure: Twenty-four lots of seed, with bushel-weights ranging from 17 lb. to 28 lb., were divided into three, two portions being shipped to Suttons and the other retained here for two monthly tests. Of the two shipped, one was forwarded as ordinary cargo and the other in cool storage. Tests were conducted here and by Suttons every alternate month. Moisture tests were also made here and in England (five hours at 100° C.) on Nos. 1–12. The losses of moisture during shipment are shown in Table 3. As the whole of the seed arrived in excellent condition it is impossible to correlate these figures with vitality. They are given here for the reason that they will be of interest to seed-exporters. The fact that the loss in cool storage is quite regular, while the loss as ordinary cargo is less and increases with bushel-weight, is of interest.

Results: In this series the behaviour of the seed was directly the reverse to that in Series No. 1, for during a period of twelve months from harvest the fall in growth was scarcely perceptible. If anything, the seed shipped in cool storage carried a little better than that carried as ordinary cargo; but the difference is not sufficient to warrant recommendation towards making the bulk shipments in cool storage, the cost of which in any case would be prohibitive.

Unfortunately, Messrs. Sutton, through pressure of work at their seed-testing establishment, were unable to continue these tests until the growth of the seed ran out. This would have demonstrated which of the samples could retain vitality for the longest period, and also the length of time. Tests made at our New Zealand station record these data, and comparisons with these and the English tests would have given an indication of the actual lowering of vitality of each individual line. However, the number of tests made was sufficient to show that the seed from the 1923 crop was of an unusually high quality.

Further, the extended New Zealand tests showed that, contrary to expectation, certain samples of a lower bushel-weight retained vitality for a longer period than did others of a high weight. Especially is this the case with No. 2, where a low-weight seed of poor appearance retained vitality for the longest period. An explanation of both these peculiarities is offered. In 1923 the crop in Southland was delayed about one month by wet weather, and in consequence the seed was allowed sufficient time to almost completely mature. Secondly, the history of line No. 2 showed that through wet weather it was cut particularly late, was left in stook for about six weeks, stacked for

Table 2.—Showing the Results of No. 2 Series of Experiments.

Lines Nos. 1–12 were shipped in July, and Nos. 13–21 in November, 1923.

Line No.	Bushel-weight.	Test when shipped.	Tests in October, 1923.			Tests in December, 1923.			Tests in February, 1924.			Tests in May, 1924.			Tests in July, 1924.			Further New Zealand Tests, 1924–25.				
			New Zealand.	Sutton's. Cargo.	Sutton's. Cool.	New Zealand.	Sutton's. Cargo.	Sutton's. Cool.	New Zealand.	Sutton's. Cargo.	Sutton's. Cool.	New Zealand.	Sutton's. Cargo.	Sutton's. Cool.	New Zealand.	Sutton's. Cargo.	Sutton's. Cool.	Sept.	Nov.	Feb.	May.	Oct.
	lb.	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1 ..	17	83	72	65	72	56	64	74	47	69	72	38	No tests made.	No tests made.	34	No tests made.	No tests made.	27	20	11	6	0
2 ..	21	95	92	91	94	93	89	96	86	88	96	83			83			80	66	49	30	19
3 ..	21–22	93	92	94	96	83	86	97	85	93	88	79			74			69	58	32	16	8
4 ..	22	92	90	92	91	90	84	88	86	82	91	71			69			64	45	26	16	6
5 ..	22	90	82	81	96	83	75	85	77	76	70	58			54			44	30	21	10	4
6 ..	22–23	94	85	83	90	84	82	86	81	88	91	69			60			49	41	34	13	4
7 ..	23–24	92	89	87	89	89	86	85	77	88	88	64			64			55	34	27	12	5
8 ..	23–24	93	91	92	90	92	90	92	91	87	89	68			68			54	43	30	15	6
9 ..	24	93	95	99	93	93	89	95	92	89	93	79			73			68	58	38	24	8
10 ..	24	95	90	91	93	91	83	92	83	80	85	80			70			66	51	36	24	9
11 ..	25	96	95	95	89	93	89	94	84	83	91	67			68			68	40	27	12	4
12 ..	28	96	93	88	97	90	90	95	84	85	91	65			69			62	40	29	20	4
13 ..	21–22	95	..	..	..	90	..	..	79	90	91	62	94	94	58	88	88	49	38	26	13	5
14 ..	21–22	86	..	..	..	81	..	..	80	89	91	73	87	92	63	82	86	59	48	32	23	12
15 ..	21–22	91	..	..	..	86	..	..	89	89	88	74	88	89	65	86	90	60	44	34	21	5
16 ..	22–23	90	..	..	..	92	..	..	90	92	97	80	96	97	73	88	88	64	48	36	16	9
17 ..	22–23	85	..	..	..	82	..	..	88	89	93	68	86	93	67	86	89	57	37	25	17	5
18 ..	22–23	85	..	..	..	86	..	..	78	88	87	57	85	84	60	81	85	55	32	24	14	7
19 ..	23–24	92	..	..	..	89	..	..	86	89	95	71	93	92	74	88	92	66	45	35	23	12
20 ..	23–24	85	..	..	..	80	..	..	69	88	91	60	82	89	46	76	88	36	36	27	15	5
21 ..	26–27	97	..	..	..	92	..	..	88	93	96	69	91	96	62	95	93	58	36	24	13	3

about one month, and then threshed. The seed was a rather dirty straw colour, and commercially practically useless on this account. It was thoroughly and properly matured, however, and at the present time, out of the twenty-four lines, is the only one showing any growth in four days. Thus a series of experiments designed to test shipment effects furnished information of a different type. Messrs. Sutton's comments on the tests of this 1923 seed are of interest. They state: "We would like to say that these figures are very considerably above the average results obtained with Chewings fescue from New Zealand during the past ten years, and, for some reason quite unknown to us, the germination of Chewings fescue generally is far better than anything we can remember for at least twelve years."

Table 3.—Showing Loss of Moisture in Twelve Lines of Seed during Shipment from New Zealand both as Ordinary Cargo and in Cool Storage.

Line No.	Bushel-weight.	Percentage of Moisture at Time of Shipment.	Loss of Moisture.	
			Ordinary Cargo.	Cool Storage.
	lb.		%	%
1	17	13·35	1·8	2·8
2	21	13·60	1·2	2·8
3	21–22	13·44	1·5	2·8
4	22	13·45	1·9	2·7
5	22	13·39	2·0	2·7
6	22–23	13·80	2·3	2·4
7	23–24	13·21	2·4	3·0
8	23–24	13·39	2·5	2·8
9	24	13·70	2·4	2·8
10	24	13·63	2·8	3·1
11	25	13·59	3·0	2·8
12	28	13·50	2·6	2·7

Series No. 3.

This series was commenced in 1924. The weather conditions at the time of the 1924 harvest were the reverse of those of 1923, and the harvest took place earlier than usual. The No. 2 series of experiments were therefore repeated with 1924 seed in order to ascertain the difference in the behaviour of the seed for the two respective years.

Procedure: As before, the seed was divided and sent as ordinary cargo and in cool storage, but with the difference that with each line was sent a portion of the undressed seed to test the effect of machining on vitality. Apparently, through some misunderstanding, the test results are being retained until the growth has run out, and not forwarded every two months as was intended. The results have been written for, and when received will be published in the *Journal*. The results of the test carried out here are available, however, and are shown in Table 4. If any monthly column is taken it will be seen that, although the bushel-weights of the eight 1923 lines shown are lower, the average growth is higher. In January, when the seed is about twelve months old, the comparative value of the seed of the two years is particularly noticeable.

Table 4.—Showing Results of New Zealand Tests of Year 1924 Lines compared with those of 1923 Seed.

1924 Seed.

Line No.	Bushel-weight.	July, 1924.	Sept., 1924.	Nov., 1924.	Jan., 1925.	March, 1925.	May, 1925.	July, 1925.	Sept., 1925.
	lb.	%	%	%	%	%	%	%	%
22 ..	19–20	64	61	53	25	21	15	9	1
23 ..	22	85	86	73	44	43	43	32	24
24 ..	22–23	94	90	84	77	66	60	54	46
25 ..	23	92	90	79	52	49	41	35	29
26 ..	24	93	82	84	63	58	53	42	31
27 ..	24	93	95	92C	80	76	68	62	60
28 ..	25	96	92	91	79	74	67	56	44
29 ..	25	96	82	79	61	57	50	43	32

1923 Seed (showing fall of first eight lines over same length of time).

Line No.	Bushel-weight.	July, 1923.	Sept., 1923.	Nov., 1923.	Jan., 1924.	March, 1924.	May, 1924.	July, 1924.	Sept., 1924.
	lb.	%	%	%	%	%	%	%	%
1 ..	17	85	83	72	56	47	38	34	27
2 ..	21	96	95	89	93	86	83	83	80
3 ..	21–22	94	93	92	83	85	79	69	69
4 ..	22	94	92	83	90	86	71	69	64
5 ..	22	92	88	82	83	77	58	54	49
6 ..	22–23	96	94	85	86	81	69	60	55
7 ..	23–24	94	92	89	89	77	64	64	55
8 ..	23–24	95	93	91	94	91	68	68	54

Series No. 4.

This was commenced in 1925, and was designed to test the effects of early and late cutting.

Procedure: Arrangements were made with Mr. S. Lynch, of Riversdale, to allow portion of one of his crops to remain standing. A strip through the middle of the field was reserved, and was cut three weeks later than the main crop. A quantity of seed from each cut was obtained, and part has been sent to England and part to Canada for testing purposes. Seed was also saved from several stooks which had been allowed to remain out in the paddock for some weeks. In addition to these, odd lots of seed from crops which had been partly stacked and partly stook-threshed were obtained and forwarded to Canada.

Series No. 5.

In 1924 Mr. R. McGillivray, Instructor in Agriculture, Invercargill, commenced a series of top-dressing experiments on the property of Mr. W. Young, of Mossburn.

Procedure: Four ¼-acre plots were marked off and treated as follows, the dressings given being per acre: Plot 1, superphosphate (36/38), 1 cwt. Plot 2, superphosphate (36/38), 1 cwt.; blood-and-bone, ½ cwt. Plot 3, control (no manure). Plot 4, superphosphate, 1 cwt.; blood-and-bone, ½ cwt.; potash (30 per cent.), 1 cwt. These

plots were treated and seeded by Mr. Young under the supervision of Mr. McGillivray, and the seed handed to the writer for testing purposes.

The four lots have been forwarded with the seed of the No. 4 series of experiments. The results of both series (Nos. 4 and 5) will be published when the experiments are completed. Both may be regarded as preliminaries to experiments of the same nature on a much larger scale.

Miscellaneous.

In addition to these four series a large number of laboratory experiments have been conducted, which have furnished much information as to the general behaviour of the seed. Among these may be mentioned the following :—

(*a.*) Effects of various conditions and temperatures of storage: Seed in sealed containers stored better in light than in darkness.

(*b.*) Effect of various periods of cool storage: The fall in germination was greater in the case of cool-stored seed. This was thought to be due to excess CO_2 (carbonic-acid gas) in the store.

(*c.*) Effect of storage on dressed and undressed seed: The rate of fall in each case was approximately the same.

(*d.*) Effect of storage under various degrees of humidity.

One particular sample has been held since 1923, and still shows a growth of 90 per cent. in four days, while another portion under ordinary conditions grows 6 per cent. in eighteen days. This will form the basis of a future series of experiments, designed to test the possibility of special storage for bulk export.

CONCLUSIONS.

It has been general to regard factors operating on shipboard (principally tropical temperatures and high humidity) as being responsible for the deterioration of Chewings fescue while in transit. It is now, however, becoming recognized that not one single factor but a combination of factors is the cause of the deterioration. This is evidenced by the fact that some seed will arrive in perfect condition, while another line on the same boat is seriously affected, both being of a high growth when shipped. It therefore follows that ocean transit conditions have brought about deterioration, but that one particular line was resistant to the adverse conditions affecting the other. Likewise we have the case of one season's seed as a whole retaining its vitality for a longer period and shipping more satisfactorily than that of another season. It is therefore obvious that the other factor is operating prior to shipment.

Storage experiments have shown that machining has not affected seed during storage in New Zealand, and in any case it is not likely that dressing would materially weaken the germination.

There remains, therefore, only the factor of harvesting. It is well known that all living bodies—animals or plants—are more susceptible to disease if the vitality of that body is low. The same rule may be applied equally to seeds, which are living units carrying out the ordinary respiratory functions. It follows, then, that seeds of a high vitality have greater powers of resistance to adverse

temperature conditions, &c., than seeds of a low vitality; and in logical sequence it again follows that as immature seed is always of a low vitality it is this seed which, although apparently ripe, is damaged during transit and also loses its capacity of growth quickly under ordinary storage conditions.

Vitality of seed may be said to be the energy held by the germ, and must not be confused with the total percentage of germination. Vitality is measured by the speed and the vigour with which germination takes place, while percentage of germination is the total growth during a specified time. Seed of high vitality, then, germinates quickly and is more resistant to adversity.

The main factors influencing seed-vitality are (*a*) degree of maturity of the seed, and (*b*) strength of the plants producing the seed.

Maturity: As already stated, it would appear that many of the crops in Southland are cut too early and are not allowed the necessary time for the final maturation processes. Further, the crop when cut is frequently not given sufficient time in the straw, and is threshed out before the whole of the straw-sap has moved into the seed. These processes are necessary for the production of a thoroughly mature seed of a high vitality. Immature seed, although apparently ripe, will usually show a satisfactory total germination, but the vitality is always low. As previously stated, vitality is measured by speed of growth, and reference to Table 5 will show the difference between the speeds of growth of 1923 and 1924 seed, the former being thoroughly mature through late harvesting, and the latter immature through early harvesting.

Table 5.—Showing Comparative Four-day Growths of 1923 and 1924 Seed.

Refer to Table 4 for total germination at these periods. Note No. 2 and No. 5 of 1923, and refer to Table 2 for germination in January in England.

1923 Seed.				1924 Seed.			
Line No.	Four-day Growth, July, 1923.	Four-day Growth, Jan., 1924.	Bushel-weight.	Line No.	Four-day Growth, July, 1924.	Four-day Growth, Jan., 1925.	Bushel-weight.
	%	%	lb.		%	%	lb.
1 ..	61	24	17	22 ..	5	0	19–20
2 ..	92	75	21	23 ..	18	3	22
3 ..	84	51	21–22	24 ..	39	7	22–23
4 ..	80	41	22	25 ..	17	0	23
5 ..	40	36	22	26 ..	22	18	24
6 ..	73	56	22–23	27 ..	60	42	24
7 ..	79	50	23–24	28 ..	35	17	25
8 ..	84	62	23–24	29 ..	27	13	25

The average yields of the 1923 and 1924 seasons are of interest. The 1922 yield (265 lb. per acre) can be considered a good average yield, and during that year a fair proportion of the seed did not ship well. In 1923 the yield (362 lb. per acre) was high, due to predominance of well-matured plump seed. Commercially, however, the seed was not a success; it was "poor" in colour and its general appearance against it. This was the finest seed produced in Southland for ten years. In 1924 the yield was very low (162 lb. per acre), and the seed

generally of a lower standard of vitality, but commercially it was "excellent" in appearance. In 1923 the seed was dark straw-grey in colour, and in 1924 the blue-purple grey predominated.

Colour is important commercially, but it is a disputed point as to whether the highly coloured seed is the most mature. The indications are that it is not, and that seed straw-coloured on the glume and grey over the kernel is of the best type.

Strength of the plants: Weak, thin plants cannot produce strong, heavy-bodied seed. The greater the number of cuts taken off, the weaker will be the plants and the greater the degree of soil-exhaustion. In this connection the statement of a prominent English firm of seedsmen regarding Chewings fescue is of interest. They state: "Ten years ago and before that period this seed reached us usually weighing 28–30 lb. to the bushel; it now, as you probably know, rarely runs above 24 lb. on the average." This was brought under the notice of one of our Southern seedsmen, who stated that ten years ago seed came off the mill weighing 24–26 lb. per bushel, whereas 16–17 lb. is considered very satisfactory nowadays. These statements clearly support the theory of weakened plants resulting from soil-exhaustion. The absence of certain soil-constituents also affects speed of maturity.

RECOMMENDATIONS TO GROWERS.

Growers are advised to pay every attention to the production of mature seed, by delaying as far as possible cutting and threshing. It is fully realized that by extending the period of ripening there is a danger of loss by falling seed during heavy winds. This danger is, of course, less in wet than in dry weather, when the seed is much looser in the head. It is difficult to give a definite idea as to the best time to cut, as this will largely be governed by climatic conditions and will vary in different localities. It must be remembered that an extension of a day or two is valuable when seed is maturing.

If possible, the crop should be stacked for six or eight weeks after cutting. Stacking assists maturation, and the seed threshes out in better condition. If stacking is not possible, then threshing from the stook should not take place before three or four weeks.

Healthy vigorous pasture should be maintained by limiting the fescue phase of the rotation to two cuts after skim-ploughing, and by the application of artificial fertilizers. Information regarding top-dressing principles and procedure can be obtained from Mr. R. McGillivray, Instructor in Agriculture, Invercargill, who is conducting the manurial side of this investigation, and who in future will be associated with the writer in the field experiments generally.

POINTS FOR SEED-MERCHANTS.

The idea is prevalent among many merchants handling Chewings fescue that the remedy of the trouble here dealt with lies wholly with the growers. This is not entirely the case, for much of the ill reputation accorded to Chewings fescue overseas is due to the indiscriminate buying and shipping of seed which should never have left the grower's paddock. If a merchant is prepared to buy anything labelled "Chewings

fescue," then one cannot expect the grower to endeavour to produce high-grade seed. High-grade should be purchased on a quality basis, and the low-grade seed left alone, or at least not included in export lines. Blending covers a multitude of sins, and, while there is nothing against the blending of high-grade and good average seed, there is no doubt that many good lines are rendered low-grade by the addition of low-vitality seed. An equally bad practice is the blending of year-old seed with new season's. Blending year-old seed of some other species may be feasible, but not so with Chewings fescue. Vitality decreases with age, and at eighteen months, although the total growth may be reasonably high, vitality is too low for shipment purposes. Of course, should foreign buyers be prepared to take low-grade seed, it is a different matter, but generally this class of buyer is rare.

Merchants are advised to pay more attention to the percentage of growth in eight days and less to the final test. The eight-day growth gives a far greater indication of the value of a seed than does the total germination percentage. Finally, they should buy only the best, and in so doing eliminate the worst.

FUTURE EXPERIMENTS.

Growers are now fully alive to the position and are taking an active interest. Co-operative experiments will shortly be commenced on the farms of several growers with the object of obtaining data on the following points: (1) Effect on vitality of cutting at various periods; (2) effect on vitality of length of time in the stook; (3) effect on vitality of stacking as against stook-threshing; (4) degree of loss by delayed cutting for various periods; and (5) effect of top-dressing on yield and on maturity.

Laboratory experiments will be conducted on (1) colour as an indication of maturity, and (2) degree of humidity in relation to life of seed.

ACKNOWLEDGMENTS.

The writer desires to thank Mr. G. Bishop, of Messrs. J. E. Watson and Co., Gore, and Mr. J. Macassey, of Messrs. A. S. Paterson and Co., Dunedin, for valuable advice and assistance, and, together with Messrs. Wright, Stephenson, and Co., Gore, for supplies of seed; to Messrs. Sutton and Sons, Reading, England, and the United States Department of Agriculture, Washington, for interested co-operation in carrying out germination tests; to Mr. S. Lynch, of Riversdale, for co-operation in field experiments; and to Mr. R. McGillivray, Invercargill, for assistance and advice generally.

REFERENCES.

ARMSTRONG, S. F. British Grasses. Cambridge, 1917.

PIPER, C. V. Forage Plants and their Culture. New York, 1924.

STEBLER, F. C., and SCHROTER, C. The Best Forage Plants. London, 1889.

WITTMACK, Dr. LUDWIG. Landwirtschaftliche Samenkunde. Berlin, 1922.

THE SECOND IMPERIAL ENTOMOLOGICAL CONFERENCE.

INSECTS AND THE WELFARE OF MAN.

J. G. MYERS, New Zealand Delegate to Conference.

"IT is not too much to say that the margin between sufficiency and starvation for the needs of the increasing population of the world during the next fifty years will in a large measure depend upon the success or failure of the work of trained entomologists." These words of the New Zealand delegate to the First Imperial Entomological Conference may fittingly introduce a short account of the second Conference and of the place of entomology in the economy of the Empire.

In 1920, at the first Conference, it was decided to hold similar meetings every five years. Accordingly, at the instance of the Honorary Managing Committee of the Imperial Bureau of Entomology, the Secretary of State for the Colonies issued invitations to the oversea Governments for a Conference in London in June, 1925. The official delegates represented no fewer than twenty-six dominions and colonies, from the Territory of Northern Ireland southward to the Union of South Africa, and from Trinidad eastward to the Malay States, Fiji, and New Zealand. But the delegates represented more than this; fortunately for the success of the Conference and for its value as a meeting-ground for scientific discussion they were also, to a large measure, representative of applied entomology in the countries which had sent them. It is regrettable that a few of the dependencies sent non-entomological delegates. For the greatest success of such a meeting it is essential that the delegates be technically capable of discussing on a common basis of knowledge the entomological problems of the countries concerned. To the high proportion of working entomologists among the delegates, and to the care and efficiency of the authorities in charge of the Conference arrangements, must be attributed the outstanding success of the meeting—a success which will probably contribute to the consideration of the successive Imperial Entomological Conferences, as milestones in the progress of applied entomology within the Empire.

At the outset, a delegate must find it by no means an easy task in a written report to do justice to the benefits accruing from the Conference. What must we take as the measure of such a meeting's success? Not the total contents of papers read; not the stimulating discussions following their delivery; not the deliberations of the special committees, nor the resolutions passed by the Conference as a whole; not the new publicity given to the fact that applied entomology is a vital force in our midst—not any one of these activities, nor yet their *tout ensemble*, presents a fair or a complete picture of the work of such a Conference. But although it has become a truism that the greatest value of scientific conferences lies in the establishment of personal contacts and the interchange of opinions behind the lines, as it were, yet the report of such a meeting, either because of the

essentially personal nature of the benefits derived, or even because the delegate is often unconscious of their full extent himself, must deal largely with the above-enumerated outward and visible signs of an inner grace.

The proceedings opened with an address by Earl Buxton, Chairman of the Managing Committee of the Imperial Bureau of Entomology. He described the very great increase which had taken place year by year in the work of the Bureau since its foundation in 1913; and he was glad to be able to report that the minimum revenue of the Bureau as suggested by the 1920 Conference was now in sight. This sum, £13,000, is, however, by no means large, and an increase would enable the operations of the Bureau to be very advantageously extended. The United States Bureau of Entomology, for comparison, receives as much as half a million sterling in annual appropriations.

To New Zealand farmers unacquainted with the work of the Imperial Bureau a few words of explanation may be here appropriate. Every month the Bureau publishes a *Review of Applied Entomology* in two series, one covering agricultural entomology in the widest sense, and the other dealing with the medical and veterinary aspects of the science. English abstracts are given of papers in all European languages and in several Oriental tongues. No other publication covers the whole field of entomology in its economic applications in so comprehensive and in so rapid a manner. The *Review of Applied Entomology* is now the first essential of the economic entomologist throughout the world, and for the entomological pioneer far distant from library facilities and in the farthest outposts of colonization it is often the one means by which he may learn of the work of others. The *Review* is thus of international importance.

As a second great feature of its activities the Bureau identifies insects sent in by working entomologists from all parts of the world, and acts as a central clearing-house for entomological matters throughout the Empire. During the year 1924–25 no fewer than 63,676 specimens were dealt with in this way. With the steady increase in the number of insect species recorded as pests, and with the progress in the study of their parasites and other natural enemies, such a service becomes every year more essential. And every year, too, it becomes more difficult for the overseas entomologist, away from great central reference collections like that of the British Museum, to identify the insects on and with which he is working. Until the entomologist knows the name and systematic affinities of the insect he has to control he is groping in the dark; his results may be not only useless but often positively misleading. It can be no exaggeration to state that the progress of entomology in New Zealand has been delayed twenty years by mis- or non-identification of the insects concerned. The correct name of an insect—a mere double-barrelled Latin tag to the layman—is the key to all recorded knowledge of that insect; it is the "open sesame" to the storehouse of human experience regarding that insect and its allies.

Did the Imperial Bureau confine its activities to these two departments it would still repay in full measure the annual contributions made to its upkeep by the respective oversea Governments. But it concerns itself also with the publication of other journals, including the *Bulletin of Entomological Research* and the *Insecta* portion of the *Zoölogical*

Record; it distributes collections of named insects to educational institutions and to oversea Governments; it lends books and papers to oversea workers; and finally it exports beneficial parasites to the colonies and dominions. A plan was brought before the Conference by which the last-mentioned activity would be considerably extended and placed on a permanent basis. New Zealand has already reaped some benefits from this parasite work by the receipt of consignments of earwig and pear "slug" enemies at the Cawthron Institute. More recently the task of the present delegate in finding, studying, and despatching to the Department of Agriculture in New Zealand parasites of the pear-leaf-curling midge was very materially facilitated by the Bureau, and since his departure from Europe this work is being continued under the direct auspices of the same institution.

With the numerous papers on all aspects of economic entomology presented at the sessions of the Conference it is not proposed to deal here. But the very able address of Dr. G. A. K. Marshall, Director of the Imperial Bureau of Entomology, on the aims and organization of economic entomology, requires more than passing mention. Applied entomology has evolved largely in response to conditions of large-scale agriculture in new countries where the rule-of-thumb procedure which achieved satisfactory results in the older settled countries was left helpless against huge outbreaks of pests. On the overseas biologist visiting England, or, indeed, any of the older European countries, the deepest impression is one of balance between man's agricultural and pastoral activities and the operations of nature. The two have functioned for so many centuries side by side that the old antagonists, if not lying down together like the lion and the lamb, at least seem to enjoy a fairly permanent armistice. But in a new country, how far different is the case. The landscape may be swept clean of forest by fire, and the native vegetation may be replaced, as in New Zealand, by a highly unstable plant-formation in the form of grassland, or, as in other countries, by practically pure stands of single species like sugar-cane or cotton. Insects living on such plants find their food increased beyond all bounds, and they themselves multiply proportionately. The problem of control then assumes such vast proportions that almost necessarily it becomes a matter for Government action.

Dr. Marshall, beginning his address, stated that under the system which now prevails in most countries where agricultural entomology is organized the farmer calls in the entomologist usually, if at all, only when the damage is done. The psychological attitude of the farmer in these matters, due entirely to the development of applied entomology as outlined above, is radically unsound. What is needed is the application of entomology to all stages of agricultural practice in order to prevent rather than to control insect attack. Such co-operation can, however, hardly be accomplished in the full measure desirable unless the entomologist is as much a part of the administration of the farm or plantation as the cultivator himself, and such close contact cannot possibly be achieved by the scanty staffs of Government entomologists. The function of the latter must necessarily be almost entirely advisory. The remedy lies in the employment of entomologists by plantation-owners and by associations of farmers themselves. The way has

been splendidly indicated by the Hawaiian Sugar-planters' Association, whose experiment-station staff has now won such complete control that Hawaii, in the words of the station director, has now no insect which is at present to be considered a major pest of sugar-cane. "But our existing method itself placed an obstacle in the way of such a development, for the Government Departments insisted on giving away entomological advice and assistance free of charge. Such a system not only produced very unsatisfactory results, but also prevented the public from learning to appreciate the commercial value of entomological knowledge. There was no adequate reason why a man should not pay for skilled entomological advice just as he pays for the skilled advice of the lawyer or the medical man." (Report on the Second Imperial Entomological Conference, London, 1925, p. 26.) The time is thus envisaged when associations of planters and farmers generally will employ their own entomologists. It was even suggested that some hotels might with advantage follow their example!

In connection with the Conference, trips were arranged to Oxford, Cambridge, and Rothamsted, and the thanks of the delegates must be accorded for the very full hospitality dispensed to them not only at those places but in London itself.

To conclude with a word on the scope of "economic" entomology, the present delegate would submit that no definition can be too wide, nor can the most recondite and academic investigation in entomology be characterized as useless. At the Imperial Conference, which was essentially a meeting of practical men, stress was laid heavily on the need for primary research in insect biology, rather than so-called "practical" study having for its only object immediate control. Control based on such a flimsy basis too often proves only a palliative. A few weeks after the close of the Imperial Conference, at the sessions of the Third International Entomological Congress held at Zurich, signs of a complete *rapprochement* between the applied entomologist, the academic worker, and the old amateur—to which latter class entomology is perhaps more indebted than any other science—were apparent not only in the personal attitude of the delegates, among whom professional economic entomologists were in strong force, but also in the subject-matter of the papers read.

It remains for agriculture, for forestry, and for medicine to utilize to the full the services which entomological workers, in combination, are prepared to render to human welfare.

Drugs and Instruments for Dairy Farm.—In reply to an inquiry the Live-stock Division furnished the following list of articles that would be found useful: Epsom salts, ground ginger, saltpetre, bicarbonate of soda, carbonate of ammonia, Condy's crystals, antiseptic (Kerol, &c.), raw linseed-oil, turpentine, washing-soda, mustard, vaseline, trocar and canula (medium size), teat-tubes, milk-fever outfit, funnel, and tubing.

Pasteurellosis.—This disease was demonstrated last year to have occurred among pigs on three farms in the Feilding district, where some mortality took place as a result. The outbreaks were taken in hand by the Live-stock Division, and by a process of isolation and disinfection of the sties the outbreaks were checked and no further trouble was experienced.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR THE CURRENT YEAR.

(Continued.)

L. D. FOSTER, B.Sc., Analyst, Chemical Laboratory, Wellington.

II. CHEMICAL ANALYSES.

IN any work connected with the experimental milling of New Zealand wheats chemical analyses of the flours are of value for several reasons. Of these the most important to the investigator is the bearing the composition of wheat and flour has on strength. In addition, however, analyses may be of considerable use to the miller and the baker: to the former they may suggest improved methods of handling and treatment in the mill; to the latter they may give some idea of the better results to be obtained by some slight variation in the mixing of doughs, or, later, in their fermentation.

SIZE AND SHAPE OF LOAF.

The quality or strength of a flour is judged by the size and shape of the loaf that is baked from it. The baker, of course, looks for additional qualities such as colour and texture, but the size of a loaf (its volume) may be taken as a dependable measure of its strength, provided that uniform quantities of flour, yeast, salt, and sugar are used in its making.

PROTEIN AND STRENGTH.

The strength of a flour is closely connected with the amount of protein it contains. Although there are apparent exceptions to this statement, it is a fact that if one takes a sufficiently large number of samples and eliminates as far as possible the effect of exceptions by averaging the protein content of all flours with the same baking-value it is found that good strength is associated with high protein content; and, conversely, flour of poor strength is associated with low protein content.

It may be explained here that "protein" and "gluten" are for the present purposes interchangeable terms. "Gluten" is the name given to that part of the flour which remains when the starch has been washed away. "Protein" is an inclusive name under which many allied animal and vegetable substances are grouped; gluten is one of these proteins. The amounts of gluten and protein should agree; they do agree fairly well, and for present purposes any discrepancies may be disregarded. The accuracy of gluten determinations depends on several factors which are difficult to control; the temperature of the water used, the length of time of washing, the character of the salts dissolved in the water all influence the result. The protein figure, however, may be determined by chemical means, and is the more exact.

The first illustration (Fig. 2) shows the general effect of protein content on loaf-volume. The reproduction is from a tracing of the outlines of two loaves, and represents the volumes of one of the best and one of the poorest in protein content of the flours from wheats received from the Ashburton Experimental Farm this year.

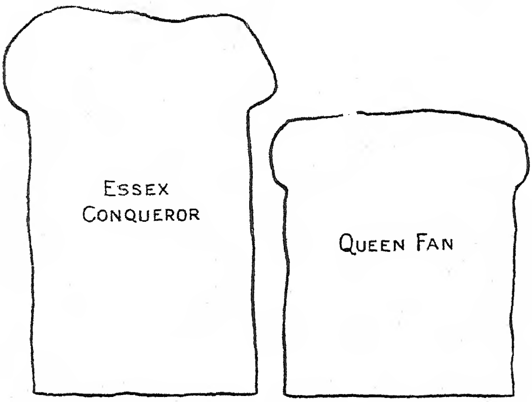


FIG. 2. SHOWING EFFECT OF PROTEIN CONTENT ON LOAF-VOLUME.

Outlines of loaves from one of the best and one of the poorest in protein content respectively of flours obtained from Ashburton Experimental Farm wheats. On left: Essex Conqueror (S 774); volume, 755 c.c.; protein, 14·69 per cent. On right: Queen Fan (S 766); volume, 570 c.c.; protein, 10·31 per cent.

Where the protein content of a flour fails to give a fair indication of the loaf which may be baked from it one may look to the *quality* of the gluten as a possible source of the trouble. The amount of gluten (or protein) may be quite satisfactory, but if its quality is below the average, then that flour will fail to make a good loaf. A separation of the gluten is therefore useful, since it enables one to examine its physical state and so gain some idea of its strength, &c. The difference in appearance between glutens obtained from weak and strong flours is indicated in Fig. 3.

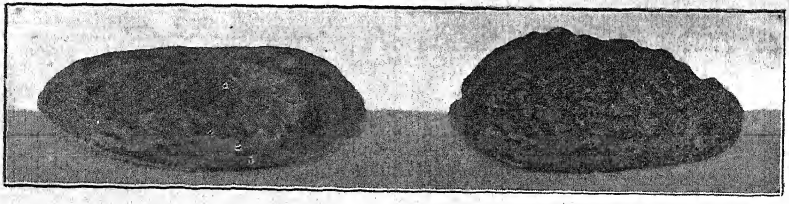


FIG. 3. ILLUSTRATING THE QUALITY OF GLUTEN.

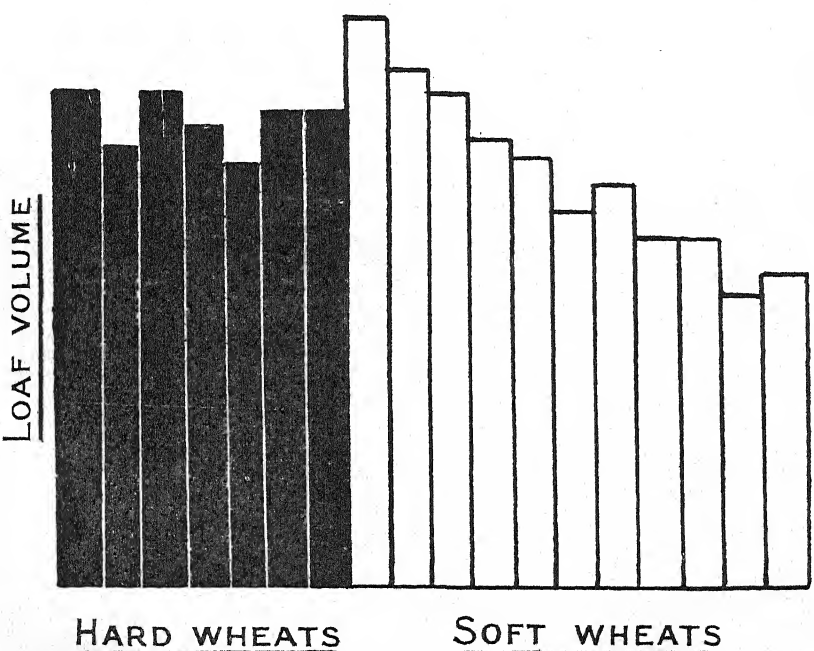
The weak gluten, on left, possesses poor cohesion and elasticity, and has flattened out on warming. The strong gluten, on right, possesses good cohesion and elasticity, enabling it to retain its ball-shaped form on warming. Actual size.

[*Photo by F. T. Leighton.*

HARD AND SOFT WHEATS.

In this connection it may be noted that wheats may be divided roughly into two classes. "Hard" wheats, as the name implies, are hard in texture and generally horny and translucent when broken across the grain; they usually produce flours of good strength, high in protein content, and baking into loaves of good size, shape, and texture. "Soft" wheats, on the other hand, are floury in texture, produce as a rule flours lacking in strength, lower in protein content, and making smaller loaves.

The truth of this statement is shown in Graph 1, which illustrates the comparative volumes of the loaves obtained from the reputedly hard and soft varieties tested this year containing over 10 per cent. protein. The general tendency of hard wheats to produce larger loaves than soft wheats is clearly indicated.



GRAPH 1. VOLUMES OF LOAVES OBTAINED FROM HARD AND SOFT WHEATS.

The hard wheats show a decided tendency to produce loaves of good volume. Soft wheats are not so consistent in this respect. These samples all contained over 10 per cent. of protein, and are arranged in each series in order of decreasing protein content from left to right. The names of the hard wheats are Yeoman (S 775), Marquis (S 769), Velvet (S 771), Velvet (S 773), Velvet (T 37), Marquis (T 50), and Red Fife (S 777); the soft wheats are Essex Conqueror (S 774), Scandinavian (S 779), Snowdrop (S 772), White-straw Tuscan (S 770), Hybrid W (S 778), Zealand (S 776), Queen Fair (S 767), Major (S 760), Jumbuck (S 768), College Hunter's (T 75), Queen Fan (S 766).

From the foregoing considerations it will be seen that the percentages of protein give a certain amount of information as to the strength of flours, and are the most important figures in the main table of results accompanying this article (Table 5). In addition to these, however, other results possess a certain significance, and a brief description will be given of the importance that can be attached to them.

MOISTURE.

New Zealand wheats produce flours which are very constant in moisture content, rarely varying beyond 13·5 to 15 per cent. The amount of moisture present is to a certain extent connected with the percentage absorption of water (see below). Other things being equal, the more moisture flours contain the less water will they absorb when being made into a dough. In another respect, too, the amount of moisture must be watched, because of the bearing it has on the keeping-qualities of the flour. Too much moisture provides moulds and bacteria with an environment in which they can thrive and multiply. Naturally, the less moisture there is present the greater is the freedom from this kind of contamination; a safe maximum is about 14 per cent. of moisture.

ABSORPTION OF WATER.

The percentage absorption of water gives an idea of the amount of water which will be taken up in mixing the dough. A flour absorbing a large amount of water generally produces a loaf which is more palatable, more nutritious, and larger in volume than a flour with a poor percentage absorption. In addition, a flour with a large absorption naturally makes a larger weight of bread (a greater number of loaves). From the bakers' point of view this is of considerable importance.

RATIO OF WET TO DRY GLUTEN.

To the baker the ratio of wet to dry gluten may indicate approximately the strength of the flour and its probable behaviour during fermentation. A flour of good strength will generally have a ratio of from 3·0 : 1 to 3·1 : 1. With a higher ratio the flour tends to become weak and will not stand much fermentation. A flour with a ratio of 2·9 : 1 to 3·0 : 1 will contain a good elastic gluten, and will generally give good results in the bakehouse. Below these figures the gluten tends to become tough, and the dough needs fairly strong treatment to soften the gluten sufficiently for good results. A flour with a ratio below 2·7 : 1 must be viewed with suspicion, as it will probably contain gluten of poor quality and will not make a good loaf.

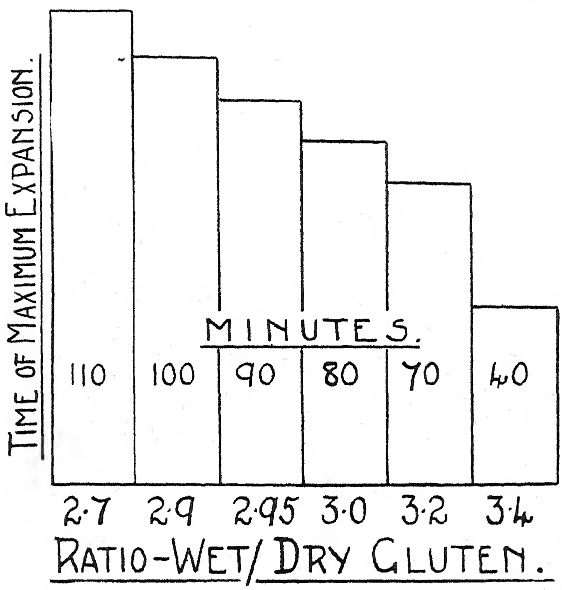
Table 3 illustrates the connection between the ratio of wet to dry gluten and the time of maximum expansion during fermentation (first rise). These figures were obtained by observing the time taken by the doughs to reach their maximum volume during the first rise; the flours were then arranged according to the times they had taken, being grouped into series differing by ten minutes in time of expansion. The averages

of the ratios of wet to dry gluten were then calculated, the following figures being obtained :—

Table 3.

Ratio Wet/Dry Gluten.	Time of Maximum Expansion during Fermentation. (First Rise.) Minutes.
2·7 : 1	110
2·9 : 1	100
2·95 : 1	90
3·0 : 1	80
3·2 : 1	70
3·4 : 1	40

These results are shown diagrammatically in the following graph :—



GRAPH 2. SHOWING THE CONNECTION BETWEEN "TIME OF MAXIMUM EXPANSION" DURING FERMENTATION AND THE RATIO OF WET TO DRY GLUTEN, AS DETERMINED ON THE SAMPLES OF FLOUR MILLED IN 1925.

ASH.

The percentage of ash is a guide to the grade of the flour and to the degree of completeness of the milling. The following figures show the percentages of ash usually found in the different grades of flour :—

Table 4.

	Ash. Per Cent.
Patent flour (90 per cent.)	0·42–0·48
Straight patent	0·48–0·54
Straight grade	0·54–0·61
First clear	0·61–0·66
Second clear	0·66–0·75
Low-grade clear	0·75–0·90

These flours, milled experimentally, are all straight-grade flours, and with few exceptions their ash figures fall within the limits set for this grade. Durum wheats are known to be high in ash content, and those examined this year also show this characteristic.

The flours in Table 5 in this series are arranged in order of the quantity of the protein which they contain. At the same time due consideration must be paid to the *quality* of the gluten, for, however high the protein content is, if it is poor in quality the flour will fail to produce good bread. In Table 5 quality is considered from the observed physical state of the different glutens on washing, their cohesion, elasticity, and colour. This method has certain limitations, but serves at least as a useful guide, especially on fresh flours such as these experimental samples. Two chemical methods of determining quality will be considered in a later paper.

NOTES ON RESULTS PRESENTED IN TABLE 5.

The wheat variety with the highest protein content of the 1924 samples was a sample of Durum, with 11·81 per cent.; its absorption figure was good, but the percentage of ash was very high for a straight-grade flour. The quality of the gluten for this flour, however, was distinctly poor; in colour the flour was a dark cream. This is all in keeping with the general characteristics of Durum wheats; the flours from them are decidedly yellow in colour, and have a sugar content much above the average, being for this reason useful for blending with flour low in this respect. The percentage of ash is high, though this is said to have no effect on the baking-qualities. Their strength is generally considered to be poor, but now that methods of conditioning these wheats are better understood improvement has been made in this direction.

Central Otago Wheats.

The rest of the 1924 samples came from Lake and Vincent Counties. S 709 (Tuscan) contained a good amount of gluten (or protein) of poor quality; its absorption-of-water figure was good. S 712 (Tuscan) contained a medium amount of protein, but this was good in quality. The rest of these Central Otago samples were low in protein content, but without exception the quality of the gluten was good and well above the average of samples tested this year. These flours would consebuently be expected to produce loaves better than the amounts of protein indicated. They were also characterized by absorption-of-water figures well above the average, S 711 and S 710 being particularly good.

Canterbury and Southland Wheats.

Essex Conqueror topped the 1925 samples with 14·69 per cent. of protein. This variety was also the best in protein content of the miscellaneous wheats examined in 1924; it then contained 15·13 per cent. The quality of the gluten in the 1925 sample was only medium, but, notwithstanding this, Essex Conqueror would be expected to produce a loaf better than the average. The next sample, Yeoman (S 775), contained a very good amount of protein (14·19 per cent.) of fair average quality; it appeared to be a good strong sample, quite in

Table 5.—Chemical Analyses.

Laboratory No.	Variety.	Where grown. Locality.	Where grown. County.	Calculated Weight per Bushel.	Flour.	Moisture.	Absorption of Water.	Gluten, Wet.	Gluten, Dry.	Ratio of Wet to Dry Gluten.	Protein (N. × 6·25).	Ash.	Colour of Experimental Flour.	Quality of Gluten by Appearance.
						1924 Wheats.								
				lb.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.		
392	Durum	..	..	66·8	75·4	13·94	56·0	32·17	11·53	2·80 : 1	11·81	0·87	Dk. cream	Poor.
709	Tuscan	Arrowtown	Lake	66·2	72·7	13·48	54·2	33·98	11·56	2·94 : 1	11·75	0·61	,,	Fair.
712	,,	Gibbston	,,	67·8	73·7	13·25	53·2	24·85	8·70	2·86 : 1	9·38	0·59	Good	Good.
708	,,	,,	,,	66·4	72·6	13·51	53·6	20·74	7·72	2·69 : 1	8·69	0·62	Poor	,,
711	,,	Arrowtown	,,	66·4	71·2	13·58	56·2	22·50	7·93	2·89 : 1	8·56	0·49	Good	,,
710	,,	Miller's Flat	,,	66·0	73·7	13·32	56·6	22·52	7·61	2·96 : 1	8·50	0·54	,,	,,
713	Hunter's	Tarras	Vincent	62·6	72·3	13·02	50·8	18·19	6·49	2·80 : 1	7·69	0·54	White	,,
714	Velvet	Ardgour	,,	63·8	74·4	13·11	54·6	17·74	6·43	2·76 : 1	7·19	0·49	,,	,,
						1925 Wheats.								
774	Essex Conqueror	Ashburton	Ashburton	63·0	75·1	13·74	51·4	45·32	13·91	3·26 : 1	14·69	0·63	Medium	Medium.
775	Yeoman	,,	,,	63·0	74·2	13·55	48·0	49·34	14·98	3·29 : 1	14·19	0·63	,,	Fair.
769	Marquis	,,	,,	66·8	70·0	13·62	49·6	43·87	14·20	3·08 : 1	13·75	0·38	Good	,,
779	Scandinavian	,,	,,	59·4	73·3	13·41	48·2	43·68	13·43	3·25 : 1	13·75	0·56	Dk. cream	Medium
771	Velvet	,,	,,	67·2	74·3	13·49	50·0	43·78	12·93	3·39 : 1	13·56	0·56	Good	Fair.
772	Snowdrop	,,	,,	61·6	73·5	13·40	47·6	45·59	13·72	3·32 : 1	13·50	0·53	,,	Medium.
770	White Tuscan	,,	,,	65·0	73·6	13·49	49·8	39·75	11·97	3·32 : 1	12·25	0·56	,,	Fair.
778	Hybrid W.	,,	,,	64·7	73·4	13·71	47·6	35·74	11·28	3·17 : 1	11·88	0·57	Fair	Medium.
773	Velvet Ngapara	,,	,,	65·4	76·2	13·66	50·8	36·21	11·61	3·12 : 1	11·88	0·56	Good	Fair.
78	Durum	Hinds	,,	65·8	69·1	13·69	51·6	38·10	12·21	3·12 : 1	11·81	0·70	Dk. cream	Medium.
776	Zealand	Ashburton	,,	69·4	77·0	13·61	50·4	31·09	10·43	2·98 : 1	11·63	0·51	,,	,,
767	Queen Fair	,,	,,	67·2	71·7	13·62	52·8	38·16	11·64	3·28 : 1	11·31	0·63	Good	Fair.
37	Velvet	Lincoln	Springs	68·0	71·1	14·29	50·0	34·56	10·64	3·25 : 1	11·13	0·45	,,	,,
50	Marquis	Gore	Southland	66·4	70·6	14·07	54·4	32·25	11·00	2·93 : 1	10·88	0·62	Dk. cream	,,
768	Major	Ashburton	Ashburton	65·4	72·0	14·35	50·0	35·95	10·97	3·28 : 1	10·75	0·59	Good	,,
765	Jumbuck	,,	,,	66·4	71·7	13·86	60·8	31·66	10·30	3·08 : 1	10·69	0·59	Medium	,,
777	Red Fife	,,	,,	67·6	72·0	13·67	51·6	27·23	9·85	2·76 : 1	10·56	0·52	Good	Good.
75	College Hunter's	,,	,,	67·2	73·4	14·00	51·4	28·53	9·31	3·07 : 1	10·31	0·48	,,	Medium.
766	Queen Fan	,,	,,	66·4	72·3	14·10	48·8	27·33	10·05	2·72 : 1	10·31	0·64	,,	Fair.
77	Solid-straw Tuscan	,,	,,	68·0	71·7	13·80	52·4	28·52	9·54	2·99 : 1	9·69	0·49	,,	,,
51	Major	Gore	Southland	64·7	70·8	14·13	55·2	27·31	8·73	3·13 : 1	9·63	0·56	Medium	Medium.
52	Solid-straw Tuscan	,,	,,	64·4	69·3	14·22	54·4	28·62	8·96	3·20 : 1	9·44	0·54	Good	Fair.
76	Velvet	Ashburton	Ashburton	67·6	72·3	13·46	51·8	26·59	8·34	3·19 : 1	9·25	0·51	,,	,,
101	Hybrid W.	Horrelville	Eyre	65·8	77·3	14·14	49·4	25·29	8·32	3·04 : 1	8·75	0·56	White	Medium.

keeping with the reputation this variety has gained in England. A sample of Marquis (S 769) was nearly as good (13·75 per cent.); last year a sample from the same locality contained 13·80 per cent. Scandinavian, a wheat of mealy texture, contained a very good amount of protein which was only medium in quality; this sample was low in its calculated weight per bushel. The best sample of Velvet received was S 771, with 13·56 per cent. protein; this was of average quality, but the ratio of wet to dry gluten was rather high; this sample would prove rather quickly. Snowdrop (S 772) was rather low in its absorption-of-water figure; it was a very good wheat as regards its protein content, though the quality of its gluten was only medium. The above may be classified on their protein content as very good wheats.

A sample of White Tuscan (S 770) was a good wheat. Hybrid W (S 778) and Velvet Ngapara (S 773) were much about equal, though the Velvet contained a rather better quality of gluten. The Durum wheat from Hinds contained a good amount of protein of medium quality; its ash was high. Zealand (S 776), with the highest calculated weight per bushel and an excellent yield of flour, contained a good amount of gluten of medium quality; the colour of this flour was a dark cream. Queen Fair (S 767) was a good wheat, and Velvet (T 37) much about the same. The sample of Marquis (T 50) from Gore contained a good amount of protein, and possessed a capacity for water above the average (54·4 per cent.). In quality this was the best of the Southland samples. Major (S 768) was a good wheat. Jumbuck (S 765) was marked by an excellent capacity for water (60·8 per cent.). Red Fife (S 777) contained a good amount of protein the quality of which was well above the average; this should be a better wheat than the amount of protein indicated.

The remainder of the samples may be classified as medium samples, with the exception of Hybrid W., which was poor.

VARIETIES AND LOCALITIES.

The samples from the Central Otago district were not characterized by high protein content, but they possessed in every case but one gluten of a quality above the average. On a basis of protein content they do not therefore show to advantage; the quality of the gluten would, however, more than compensate for what they lack in quantity. The two samples from Vincent County were low in protein, but this was above the average in quality.

The best of the Southland wheats was a sample of Yeoman—a good medium-strong wheat; all Southland samples showed, however, an absorption-of-water figure well above the average. The remainder of the wheats tested were grown in Canterbury, and the bulk of these at Ashburton. The Ashburton samples showed the very good average this year of 12·04 per cent. protein; last year the average was 12·96 per cent. Essex Conqueror, for the third year, headed the list of the miscellaneous samples from Ashburton. Other undoubtedly good samples this year were Yeoman and Marquis. The absorption-of-water figure for these samples was generally on the low side, Jumbuck being a notable exception.

SUMMARY.

Very few of the better-known varieties were received for testing during the autumn of 1925.

Only a few samples of Velvet were received, but they maintained a good average. The miscellaneous varieties were again remarkable for their average very good strength. With very few exceptions they were grown at the Ashburton Experimental Farm ; this is the second year in which the Experimental Farm samples have been noteworthy in this respect. The following may be classified, on their protein content, as strong wheats : Essex Conqueror, Yeoman, Marquis, Scandinavian, and Snowdrop. Seven are, on this basis, medium strong wheats : Hybrid W, Zealand, Queen Fair, Major, Jumbuck, and Red Fife.

Again no correlation was found between calculated weight per bushel and protein content.

(Series to be continued.)

ALBANY EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1924-25.

C. J. HAMBLYN, B.Ag., Assistant Instructor in Agriculture, Auckland.

THE season of 1924-25 was a comparatively favourable one for this gum-land area. An early spring followed by a summer of good rainfall gave the crops and pastures a good start. A long dry spell in the autumn checked growth somewhat, showing, however, to advantage the drought-resisting qualities of paspalum and kikuyu among the grasses, and of chou moellier, Japanese millet, and, to a lesser extent, mangolds among the fodder crops.

The crops as a whole, in spite of the favourable season, were poor, due largely to the ravages of small birds—which find secure shelter in the numerous hedges—to fungoid and insect pests, and to weeds, including twitches of various kinds and sorrel, with which the land, through continuous cultivation, has become very foul. In general, the work on the area was confined to demonstrations of root, fodder, and special crops, while, in pursuance of the policy outlined in the report on the area for 1923-24 (*Journal*, November, 1925), three new plots have been put down in permanent-pasture mixtures for demonstration purposes under grazing conditions. The reduction of the cropping area has enabled the limited labour strength to cope more successfully with weeds and to give the necessary cultivation to the crops.

A useful exhibit of root and fodder crops was made at the Albany Fruitgrowers' Association Show, and was appreciated by farmers and others present.

CROPS.

Mangolds.—This crop has consistently done well at Albany. A small area of Jersey Queen was sown early in November, 1924, and

three methods of applying the fertilizer were again tested: (*a*) broadcasted immediately before sowing; (*b*) side-drilled 2 in. to one side of the seed; (*c*) mixed and sown with the seed. The strike and early vigour of the young plants were appreciably better where the seed was mixed with the manure even a week before sowing. There was no indication that side-drilling the manure gave better results than broadcasting.

Swedes and Soft Turnips.—The same fertilizer-application test as with mangolds was tried with swedes and soft turnips. In both cases where the seed was mixed with the manure (3 cwt. superphosphate and 1½ cwt. blood-and-bone per acre) before sowing, the germination was poor and resowing was necessary. The strike with both the broadcasting and side-drilling methods was good. Turnip "fly" in the early stages of growth and dry-rot later caused much damage to the crop.

Chou Moellier. — A small area of chou moellier was sown in November. The crop was badly attacked by cabbage-aphis in January and February, when practically all the leaves were stripped from the plants. A good recovery was made, however, and the crop stood the dry conditions well. The plants were cut and fed to the stock, giving in two cuts a good yield of forage.

Potatoes.—A further test was made with a blight-resistant strain from Mr. S. Bilkey, Taupiri, and sufficient seed saved to sow a larger area. The strain was free from blight, which slightly attacked neighbouring rows. A number of selected English and American varieties were grown with a view to obtaining sufficient seed for further testing. Several of the varieties give indications of being good croppers. Potatoes, however, have generally given poor results at Albany, the soil being unsuitable for this crop.

Artichokes.—An area of ⅛ acre was planted in Jerusalem artichokes, at the rate of 5 cwt. seed tubers per acre, with 3 cwt. of superphosphate and 1½ cwt. of blood-and-bone manure per acre. The crop, the seed of which was ploughed in at the end of September, grew well, and yielded when dug for seed in September of this year 1 ton of tubers—that is, at the rate of 8 tons per acre. In view of the fact that the demand for artichokes for seed is rapidly increasing, this would be a payable crop on small areas in the district. From £8 to £10 per ton was offered by merchants for seed.

Cabbages.—This crop has each year given a good yield at Albany. Cabbages are easy to grow, resist drought, and provide excellent winter feed for dairy stock. It has been demonstrated that on gum-land soils cabbages can be grown to advantage for autumn and winter feed.

Japanese Millet and Red Clover.—A plot was sown at the rate of 12 lb. millet and 6 lb. red clover per acre early in November, and cut for hay in January. This makes an excellent crop for feeding off by dairy cows. The red clover grows well with the millet, and the crop can be used for hay; while the red clover provides excellent autumn and winter feed, and if top-dressed can be cut for hay the following season.

Japanese Millet and Crimson Clover.—This crop was sown at the same time as the millet and red clover, but the crimson clover was much slower in growth and did not combine well with the millet.

Maize and Peas.—A small area of maize and field-peas was tried. The peas grew well and climbed freely, the combination forming excellent forage for pigs, and, when cut and fed out, a better ration for dairy cows than maize alone.

Maize and Vetches.—This combination was also tried, but owing to the slower growth of the spring-sown vetches they were rapidly smothered and did not combine with the maize as well as the field-peas.

THE ORCHARD.

The orchard was sown half in blue lupins, at the rate of 3 bushels per acre, and half in Lotus hispidus, at 20 lb. per acre, at the end of September. Both crops were ploughed under for green manure in the autumn, the blue lupins giving the greater yield of green material for the purpose.

PASTURES.

Top-dressing Trials on Showground.—Satisfactory arrangements could not be made for the weighing of the plots on the Albany showground. This year the whole area has been top-dressed by the lessee, and the plots must now be abandoned. Although weighings have not been made on these plots, great interest has been taken in them by local farmers, and the efficacy of phosphates and lime in promoting clover-growth and improving a poor brown-top-danthonia-paspalum pasture has been clearly shown.

Cemetery Reserve.—This reserve of 3 acres has been leased for the purpose of supplying extra feed for the three heifers bought during the year to graze the grass-plots. The pasture consisted mainly of brown-top and suckling-clover. The area was top-dressed with 3 cwt. superphosphate per acre in the autumn, and a marked improvement is shown in the pasture. White clover, cocksfoot, and perennial ryegrass are already showing up, and the colour and growth of the pasture are improved.

Kikuyu and Paspalum.—This area was surface-sown with a mixture of clover (red clover, 2 lb.; Lotus major, 1 lb.; and subterranean clover, 1 lb. per acre) in September, 1924, but so far with no success. The paspalum among the kikuyu is still confined to the original plants, and has been prevented from spreading by the stronger growth of kikuyu.

Kikuyu and White Clover.—This plot was top-dressed with 3 cwt. per acre of basic superphosphate in September, 1924, and a marked improvement was shown in the growth of the white clover, which is spreading rapidly. The plot is now better grazed, and is in marked contrast to the adjoining kikuyu-plot in which there is no clover.

Kikuyu and Lotus Major.—The Lotus major continues to thrive among the kikuyu, and the two are readily eaten by stock. Lotus major has so far proved to be the best legume to combine with kikuyu. The plots without a legume (either a Lotus or clover) demonstrate clearly the value of a nitrogen-gathering plant in promoting the growth of kikuyu. When closely grazed, and especially when grown with Lotus major or white clover, the kikuyu-grass was a favourite with the stock, and provided feed from early October until the first winter frosts.

Over fifty packages of kikuyu-plants have been sent out to farmers for planting, and many are extending their areas in this grass.

White-clover Trials.—Three types of white clover—English wild white, Dutch white, and New Zealand wild white—were sown in separate plots with a mixture of English grasses in the spring of 1924. Inspections were made periodically throughout the year, and the differences in growth and habit observed.

The English wild white was slow to start away, and covered the ground slowly. This spring the growth has been more rapid. Stock showed preference throughout for New Zealand wild white, which was kept more closely grazed.

Dutch white, being more upright in growth, covered the ground very slowly, and when grazed the tips of the creeping stems were frequently eaten off, causing a check to the plant. It is a larger clover than the other two. The stock neglected this clover, which came into flower quite early.

New Zealand wild white gave a better germination than the others, and covered the ground rapidly. The stock grazed this plot closely. The indications are that New Zealand wild white provides a quicker and better ground-cover than either English wild white or Dutch white clover.

Paspalum and Subterranean Clover.—A small plot was sown with a grass mixture including paspalum and subterranean clover in September last. The subterranean-clover plants were freely eaten by birds while in the cotyledon stage. The plants that survived spread rapidly, and this spring gave a good growth. So far very little paspalum has shown up, and it would appear that the subterranean clover, Lotus major, and Lotus hispidus have smothered out many of the young paspalum-plants, which do not tolerate shade.

Cocksfoot Trials.—With a view to testing a selected strain of Danish cocksfoot against Akaroa cocksfoot an area was put down this spring in a mixture of English grasses and divided into six plots. On three of these the Danish strain was sown at the rate of 12 lb. per acre, and on the other three selected Akaroa seed at the same rate. The strike in both cases, owing to the late spring, has been fair only.

GENERAL.

As already indicated, owing to the depredations of small birds, the damage done by fungoid, insect, and other pests, and to the increase in weeds, such as twitches and sorrel (despite steady effort with hoe and cultivator), cropping at the Albany Area is difficult and uncertain. Real experimental work is now not feasible, on account of previous differential treatments of the soil, which latter has largely been converted from the original gum-land clay of better quality to a fair clay loam. The work has therefore to be limited mainly to demonstration, and for this purpose grass mixtures are being made increasing use of.

Shearers' Accommodation.—Inspection duties under the Shearers' Accommodation Act are now carried out by the Live-stock Division of the Department of Agriculture. Inspectors have already been able to bring about considerable improvements where necessary, and further work is in hand.

UNIVERSITY EDUCATION IN AGRICULTURE.

VIEWS OF ROYAL COMMISSIONERS.

Extract from report of Royal Commission—SIR H. R. REICHEL, Wales, and FRANK TATE, Victoria—on University Education in New Zealand, presented to Parliament during session of 1925.

NOTHING illustrates better the difficulties incidental to the building-up of a sound scheme of higher education in a country with the geographical configuration and the distribution of population of New Zealand than the present position with regard to agriculture in the University. The prosperity of the Dominion rests upon its rural industries, and with the classical example of their great rival, Denmark, before them one would have expected the New-Zealanders to have imitated Denmark in making the scientific education of the staff and intelligence officers of the agricultural army a most important branch of university work. In Denmark during the past fifty years there has been a remarkably close alliance between the trained men of science and the great producing interest on which the national prosperity depends. The names of Fjord and Segelcke, among many others, are held in great honour among the Danes, for these men did notable pioneer work in bringing scientific methods into the daily routine of the farm and butter-factory. The confidence of the farmers once won has never been lost, and to-day the co-operation between University and farm is loyal and complete.

It is worthy of note, however, that Denmark was satisfied with no makeshift arrangements for the training of agricultural leaders and teachers. The Royal College or Institute of Agriculture and Veterinary Science at Copenhagen, although not a part of the University, is of university standing. It is splendidly housed, and has a staff of some forty professors, many of them—*e.g.*, Westerman and Bang—of world-wide reputation. It offers advanced courses in the various branches of agriculture, and in veterinary science, in forestry, or other allied branches of rural industry, to students who have had a full course of secondary education, and who, in addition, have had two years' practical experience on a farm. The Institute supplies the directive power behind all the agricultural activity of Denmark. It controls the arrangements, carried on at selected farms, for making economic experiments in dairying, and in the feeding and breeding of animals. It makes continuous tests of butter manufactured for export. It distributes sera and vaccines necessary for combating disease in domestic animals. It is in organic touch with the Government experts in agricultural economics. Its graduates go forth as teachers, as research station officers, as counsellors employed by the farmers' associations and co-operative societies. So great is the appreciation of the work of the scientific agriculturist that over one hundred counsellors are employed as advisers throughout the country.

It is undoubted that the greatest factor in Danish success in dairying and marketing has been skilled leadership and guidance. The country has prospered not so much because the average rural worker has been reasonably well educated, but because he has been well led and advised by men whose scientific training was the best that could

be given. The Danes have realized fully that the rank and file of agriculturists should have a good elementary education. They have made a wonderful success of their system of adult education, under which farm youths of from eighteen to twenty-five years of age attend the People's High Schools, and thereafter the People's Agricultural Schools during the five winter months, while farm girls attend the same schools during the three summer months. In this way they secure a good average of general education. But it is to trained scientific leadership that they really owe their success, and in leadership the second best cannot be tolerated.

The sustained enthusiasm and the great expenditures which have been necessary to build up such an efficient school as the Royal College of Agriculture at Copenhagen have been amply justified by the great increase in national production. The history of this school illustrates the wisdom of concentrating upon one first-class institution capable of turning out first-class graduates.

How has New Zealand faced the same problem? It has endeavoured to create a degree course in agriculture by an alliance between Lincoln Agricultural College—a school designed primarily to train practical farmers—and the neighbouring University College at Christchurch. No professor is, however, at the head of the agricultural school, and, so far as we can learn, the science subjects taken at the University Colleges are not treated from the point of view of the needs of agricultural students. No special arrangements have been made for the agricultural students during their year at the University College. They attend classes in science subjects originally planned for students of pure science, or of medicine, or of home science. Naturally, therefore, the subjects are not treated from the point of view of the agriculturist. While we agree that a wide knowledge of science is invaluable, and that a student who learns the truths of foundation sciences, such as physics, chemistry, and biology, from an inspiring teacher has gained a great asset, we believe that teaching and learning gain wonderfully in reality and interest if the matter of the teaching is related to the practical concerns of the student's future vocation. Nothing is more evident in studying the product of schools and universities than the existence of a great gap between the knowledge of a subject and the power to apply this knowledge in practical affairs. This is true of students of literature, of history, and of philosophy, and it is equally true of students of science. A good teacher finds that the greatest stimulus he can give comes from relating new truths to old truths and to practical life.

No one who reads the details of the science subjects prescribed for the first year of the course for the degree of Bachelor of Agriculture would, we feel convinced, regard them as a really good introduction to agricultural study. If they were treated as pure science there would be less objection than there is at present. The whole arrangement is a makeshift, and is quite insufficient to provide the quality of agricultural leadership the Dominion requires. The university year is followed by two years of study and practice at Lincoln College. As the amount of practical farm-work is apparently considerable, there must inevitably be a lessening of the time devoted to teaching and study. The time devoted to the degree course—three years—is in itself too short, and the emphasis laid upon farm-work increases this shortage. Moreover, the great majority of students at Lincoln College

are non-matriculated and are taking the lower course designed for practical farmers. If the teachers necessarily take both groups of students for common lectures and laboratory work, it is certain that the work must be kept at a much lower standard than degree students require. Or, alternatively, there must be a great strain on teachers and degree students in providing and receiving special tuition outside the ordinary time-table.

The course at Lincoln College is by no means adequate for a good degree course. Certainly the economics of agriculture should receive much more time and attention. If one fact stands out above another in the progress of Danish agriculture it is that every question involving changes in methods of production and of marketing has been considered in its economic aspect. A Danish "counsellor" in the employ of an association of farmers does not merely inquire into and advise as to an improved balanced ration designed to produce a greater amount of butterfat, but he goes minutely into costs and returns. The confidence of farmers will never be gained and kept until this is done by his advisers, for the farmer's problem is not merely to produce in quantity, but to produce with a satisfactory margin of profit.

Since February of this year a School of Agriculture, so-called, has been established at Victoria College, Wellington. The following evidence was given to the Commission by Professor C. F. Peren, Professor of Agriculture: "The School opened at the beginning of the present academic year with twelve students. The permanent staff consists solely of myself, but lectures are also being given by three members of the Biological Laboratory of the Department of Agriculture. At present we have neither lecture-rooms nor laboratories, such accommodation being lent to us when not required for its normal uses. We have neither land nor live-stock, and must surely constitute one of the most extraordinary Schools of Agriculture which ever accepted students. During the present year we are confining our work to those subjects which can best be taken under the present conditions, but next year the situation will be extremely serious unless we are provided with proper facilities. There are, however, only eight months before the next academic year begins, and therefore, unless action is taken almost immediately, there will not be sufficient time to make proper provision, as buildings cannot be erected and laboratories equipped in a day . . . I submit that the folly of this weakness in the system of education of an agricultural country should be strongly emphasized, and that agricultural science should be presented to those in higher quarters as a very valuable combination of science and practice, not merely as a hobby for scientists."

The Commission learns that the establishment of a Chair of Agriculture at Victoria College was not part of a well-considered scheme of agricultural education adopted by the Dominion Government, but was the result of a gift to the College of £10,000. This sum, supplemented by a subsidy from the Government, is just sufficient to provide the salary of one professor. We learn further that the Auckland University College is also the recipient of a bequest of £20,000 to enable a School of Agriculture to be established in that city, and that a professor has recently been selected. In this case also the amount is not adequate for the development of the school on satisfactory lines. Accordingly, if the present arrangements are maintained, New Zealand is committed to the maintenance of three agricultural schools within

the University, not one of which can continue efficiently without a considerable increase in the national expenditure.

The question which the Government of New Zealand must decide, and at once, is whether the example of countries which have made a success of agricultural education in its highest aspects is to be followed, and whether the principle is to be accepted that the best possible training for the future directive staff of the agricultural army is the only sound policy. Second-rate and third-rate agricultural "experts" are a hindrance and a danger to agricultural progress. New countries suffer greatly from such guidance.

A properly equipped University School of Agriculture must have a staff adequate to provide a sufficient variety of courses to produce the different specialists the country requires. But to do this efficiently involves a very heavy expenditure on staff and equipment. Taking a few well-known college courses, we find that the Macdonald College of the McGill University, Canada, employs in its School of Agriculture no fewer than thirty-two professors, lecturers, and other teachers, all of them save three being university graduates. It is true that some members of the staff take classes in the two schools associated with agriculture in the College, the School for Rural Teachers and the School of Household Science; but the fact remains that the necessities of the agricultural students demand a very complete staff of highly trained specialist teachers. The College provides agricultural courses of varying duration, that for the Bachelor's degree extending over four years.

The Ontario Agricultural College at Guelph is also one of well-established reputation. It numbers on its staff some fifty-seven professors and other teachers, the great majority of whom are employed in agricultural subjects. The College also provides a department of home economics. The purpose of this College is not to train university graduates, but "to train the young farmers of Ontario in the best practices and the science of good farming, and, secondly, to conduct experiments in all branches of agriculture, the results of which are to be published for the benefit of the farmers of the province."

It will be seen from the liberal provision of teaching staff that the authorities recognize that agricultural education that is worth while must be liberally financed.

Lastly, we quote the example of one of the many colleges in the United States, the Iowa State College of Agriculture and Mechanic Arts. Iowa is about two-thirds of the size of New Zealand and has a population of two and a quarter millions. The College offers courses in agriculture, home economics, veterinary science, engineering, industrial science, and advanced courses for graduates. Students are grouped in divisions, *e.g.*,—(1) Secondary course (three years), for those who cannot reach the standard of university courses; (2) undergraduate course (four years), for those who intend to take a degree; (3) graduate course, for training in advanced work as specialists in branches of agriculture; (4) winter short courses, for farmers and their wives and daughters. The staff comprised in 1916 some 55 professors, 57 associate professors, and 196 assistants; in all, 308 members. Of these, 54 were members of the agricultural experiment station maintained in the College. The number of students in 1916 was as follows:—

(1.) Agriculture—(*a*) Graduate Division, 115; (*b*) undergraduates (four-year course), 975; (*c*) secondary course (three-year course), 213;

(*d*) winter short courses, 2,469: total, 3,772. (2.) Home economics, 987. (3.) Veterinary science, 317. (4.) Science, 214. (5.) Engineering—(*a*) Undergraduate, 746; (*b*) short courses, 1,026: total, 1,772. Grand total, 7,062.*

Our purpose in quoting these examples is to impress upon New Zealand the necessity of facing the position and establishing one really efficient agricultural college of university standing. The attempt to maintain the three centres now in being must, in our opinion, end in failure. At best each school will be doomed to what one witness called "anæmic mediocrity."

There are certain fundamental considerations which must be kept steadily in view. To-day the subject-matter of agriculture is divided into large departments with specialists in charge of each—*e.g.*, agronomy, animal husbandry, dairying, and horticulture. It is absurd to expect one man, however well informed, to profess and to teach the whole of the work of an agricultural course. And, further, the technical subjects should not be dominated by instruction in sciences taught without regard to their application to agriculture.

We are of opinion that an agricultural college in association with the University should be established in some suitable locality in the North Island by a combination of the schools proposed for Wellington and Auckland. It should provide courses for degrees in agriculture and for post-graduate work, and, in addition, should offer such lower courses as diploma courses for farm youths and short practical courses for adult farmers. As in the American and Canadian colleges, departments of home economics and ultimately of training for rural teachers should be associated with it.

Such a college will necessarily be a residential institution, and there is no reason why it should not ultimately develop into a complete residential university grouped appropriately around the study of agriculture as its leading subject. This would be strictly in accordance with the fitness of things in a Dominion so dependent as is New Zealand upon the work of its farmers. Moreover, such a scheme, under which education in liberal studies would be associated with training in the more directly practical concerns of rural life and work, would do much to help towards the development of a culture of the country as distinct from the culture of the city. How to develop widely a taste for country life and the power of finding happiness and interest in country pursuits and in the natural life of the country is a very practical problem. Intellectual ability naturally gravitates to the quarter where it finds most scope for its powers. The modern city university thus attracts to itself like a powerful magnet the best intellect of the surrounding rural districts and converts it to urban uses. The present university system of New Zealand, if left uncorrected, must continue to undermine the basic industry of agriculture, on which the whole future prosperity of the Dominion depends, inasmuch as it tends to produce a progressive intellectual impoverishment of the countryside. Nothing can effectively stop this draining process but an institution exerting an equally strong pull in the opposite direction, such as a well-equipped university or university college with agriculture as its central subject.

* Quoted from "Agricultural Education in America," A. E. Richardson. (Government Printer, Melbourne, 1918.)

The great output of engineers, doctors, and lawyers from the university colleges is a direct result of the great facilities afforded for these courses. Why not, therefore, give bright young fellows in country schools the opportunity to become leaders in scientific agriculture and other great rural activities?

Agricultural education should be the concern of each type of school in the national scheme, and a great step forward will be taken when an efficient training for rural teachers has been developed, a training which will fit them to teach efficiently a course of study adapted to rural needs and to the interests of rural life. No better position could be found for such a training course than in association with an agricultural college of the kind above described.

As to a department of home economics and farm economics for women, we consider that provision should be made for such study from the first. The part played by the woman in rural industry is no less important than that of the man, and the State should recognize this by the provision of suitable education for her. There need be no duplication of graduate courses now provided at Otago; but good diploma courses suited for farm wives and daughters would be appreciated and would be most helpful.

RANGE OF KIKUYU-GRASS IN NEW ZEALAND.

An Ashburton correspondent writes to the Editor:—

"A small quantity of kikuyu-roots was obtained from Sydney last spring, and about thirty plants were established in October on cultivated soil. They struck well, grew at an extraordinary rate, and the grass looked really beautiful; in fact, I thought that a grass was discovered that would be of enormous benefit to farmers on the dry plains of Canterbury. The stolons grew over 1 in. a day, and the cuttings, which were planted 6 ft. apart, were soon united in one tangled mass. My first disappointment was when, to test the palatability, a sheep was tethered on the fodder and it was found that it would not be eaten unless the sheep was really hungry. It is possible that this new feed may be distasteful at first, but would be eaten fairly readily when stock were accustomed to it. Some of the plants were fed close in this way in order to remove all the top growth before winter so that the effect of the frost would be apparent. However, the frost completely killed every plant, although the roots of many of them were well protected by the unfed dead leaves."

The Fields Division comments as follows:—

"In reference to the climatic conditions suitable for kikuyu, we have never recommended its establishment outside the Auckland Province. Our experience has been that it does not recover from severe frosts, and in general a line passing through Hamilton is about its southern limit. Farther south there have been cases where the grass has become established in sheltered situations and has been able to withstand frosts, but in general the grass is killed out during the first winter. North of Hamilton, however, reports are still favourable, and we have sent out approximately one hundred lots of roots in the last two seasons to farmers for trial. Sheep do well on kikuyu provided the usual stocking system is followed. At Puwera the area in this grass was closed up for two weeks after being grazed by cattle, and sheep were turned in on the young growth. This was eaten well down by them. Again, after the kikuyu had been cut for hay, sheep relished the aftermath, which they closely grazed."

Further information regarding kikuyu, to be gathered during the current season, will be published in due course.

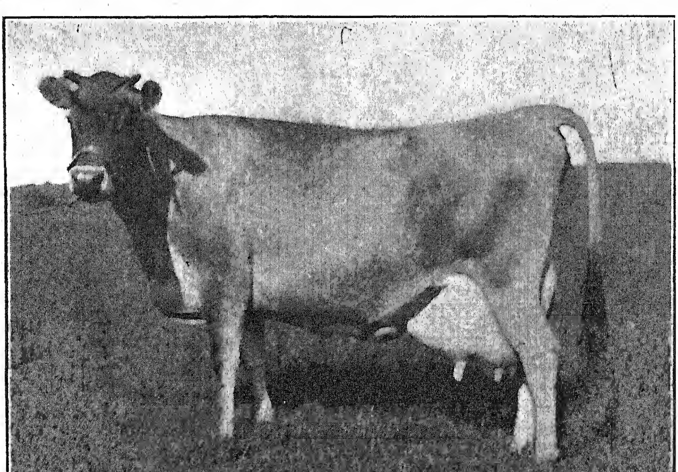
HOLLY OAK'S ANNIE.

THE JERSEY CHAMPION'S RECORD.

IN the October *Journal* a brief reference was made to the performance under certificate-of-record test of the Jersey cow Holly Oak's Annie, constituting a new high level for the breed in this country. It can now be recorded that she calved, subsequent to test, on 18th November, thus fully qualifying for her certificate. Holly Oak's Annie is the third New Zealand Jersey to gain a C.O.R. on a production exceeding 1,000 lb. of butterfat.

The production of Holly Oak's Annie, month by month, while under C.O.R. test is shown in the following table :—

Month.	Days.	Milk.	Test.	Butterfat.
		lb.	Per Cent.	lb.
1924—September	2	82·3	5·19	4·27
October	31	1,840·5	5·19	95·52
November	30	1,859·8	4·95	92·06
December	31	1,810·8	5·18	93·79
1925—January	31	1,697·2	5·70	96·74
February	28	1,448·4	5·67	82·12
March	31	1,555·9	6·02	93·66
April	30	1,423·4	6·23	88·67
May	31	1,514·7	5·91	89·51
June	30	1,419·3	6·02	85·44
July	31	1,374·9	5·97	82·08
August	31	1,356·2	6·03	81·77
September	28	1,139·3	6·22	70·86
Totals ..	365	18,522·7	..	1,056·49



HOLLY OAK'S ANNIE, OWNED AND TESTED BY W. T. WILLIAMS, PUKEHOU.

It will be observed that Holly Oak's Annie was remarkably consistent in both butterfat test and milk-production. Another point is the evidence of constitution as made apparent by the persistency of milk-flow. She was still yielding at the rate of over 40 lb. milk per day at the expiry of her 365 days on test. Her total yield for the season constitutes a New Zealand Jersey record in both milk and butterfat.

Holly Oak's Annie is a daughter of Grannie's Knight, a champion butterfat bull with some forty C.O.R. daughters to his credit. Grannie's Knight is a son of K.C.B., one of the best-known bulls of the breed in the Dominion. On the dam's side Holly Oak's Annie goes through Ancerine to Soumise Tom, a champion butterfat bull and a son of Soumise Majesty, sire of ten C.O.R. daughters. Other names appearing in the pedigree, and which speak for themselves, are Campanile's Sultan, Silver King, Fury, Monopoly, Retford Boy, and several others almost as widely known to students of the breed.

The accompanying photograph makes it clear that the new champion combines type with production, while constitution is also apparent.

—*W. M. Singleton, Director of the Dairy Division.*

INCIDENCE OF FOOT-AND-MOUTH DISEASE.

In the report of the departmental Committee appointed by the British Government to inquire into foot-and-mouth disease in Great Britain, and published earlier in the year, the following important statement occurs :—

> We are bound to agree with the view that there was something in the nature of the virus met with in this outbreak to account for the large number of cases of recurring outbreaks. There is little doubt that this outbreak has demonstrated conclusively that the opinions previously held as to the normally short period for which the virus is capable of living outside the animal body must be drastically revised.

This statement strongly emphasized the necessity for even greater care than had hitherto been thought necessary. Incidentally, some confirmation of it can be found in the fact that an outbreak occurred in California in April of this year on a farm where evidently no previous cases had occurred for some months previously.

The following extract from the report of the same Committee indicates that the conditions prevailing in dairying districts in Britain were specially favourable for the dissemination of foot-and-mouth :—

> It is generally agreed that the virus of disease met with in this outbreak remained active for a period far exceeding anything experienced in previous outbreaks, whilst the conditions prevailing in Cheshire were exceptionally favourable to the spread of infection. For example—(*a*) The heavy milking-stock carried on comparatively small contiguous grass farms ; (*b*) the absence of natural barriers—*e.g.*, large tracts of arable land, woodlands, hills, &c. ; (*c*) the necessity for daily movement of milking-stock from buildings to pastures ; (*d*) the necessity for daily handling of milking-stock ; (*e*) the visits of milkers resident away from the farms and probably keeping a few animals on their own premises ; and (*f*) the presence of faulty systems of drainage, and the lack of adequate fences between fields.

With the exception of (*e*), these conditions are also found in the dairying districts of New Zealand.

HIGH-GRADE CHEESE AND THE BRITISH MARKET.

STATEMENTS are occasionally made to the effect that the quality of cheese which has been allotted high grading-points in New Zealand does not give as much satisfaction, nor does the cheese realize as high a price, on the British markets as that which has been allotted lower points. In a recent report from Mr. Walter Wright, the Dairy Division's Inspector in London, he comments on this matter, and the following extract is quoted for general information :—

During the past few days I have interviewed the merchants who last season handled the outputs of each of the cheese-factories which last year scored the first three highest average grade points at six of the leading grading-ports. Without exception the comments of these merchants were very pleasing and encouraging. In most cases the two chief words used to express their idea of quality were "Very good." There were one or two comments regarding a little openness in the make in one or two individual factories, but all of those I interviewed on this matter were unanimous in their opinion regarding the high average quality of the cheese referred to.

The foregoing information has been from the merchants' point of view—men who have handled the goods and who are responsible for the financial returns to the dairy companies interested. My own personal opinion is an unreserved endorsement of the opinion of these people who have handled the cheese. It seems to me that adverse criticism of the grading is an endeavour to lower or depress the average quality of our cheese, simply because some of the cheese that has not scored high has probably realized on this market the same price as cheese of a higher-scoring quality. There are many factors that come into the question when the marketing of cheese is concerned. The time of arrival of the steamer, the upward or downward trend of the markets, and the season of the year are among many of the reasons that might be advanced by merchants who handle the goods. It must also be remembered that a good cheddar cheese is a good cheese the world over.

Again, I may point out that it is rather a common saying in this country that you can sell anything in the United Kingdom—good, bad, and indifferent—but at a price. This applies to the cheese-markets. There is a great variety of tastes in this country where cheese is concerned, and owing to the intimate knowledge that merchant houses have of the requirements of different districts and localities they are enabled to obtain prices that are sometimes not consistent with the quality of the goods offered. If my observations, now covering a period of several years, regarding the cheese requirements in the United Kingdom are worth anything, they have taught me that high-quality produce will always command a market at any time, no matter what the state of the market may be ; and that, on the other hand, goods of inferior or indifferent quality are always difficult to sell. A brand of cheese that is well known to the trade as being of a high average quality and uniform will always be the first to be sold on a slow market, and it is on slow markets particularly that buyers become so critical in their selection of the goods most suitable for their particular trade.

As you are aware, 2½ per cent. has been the acknowledged percentage allowed on our cheese-shipments for shrinkage. This allowance originated at a time when we were making a firm, normal cheddar cheese, and was found to be sufficient to meet trade requirements. To-day, however, the position has become somewhat altered. A week or two ago this matter was discussed between the head of one of the leading importing houses and myself, and the statement was made to me that to-day it is estimated that a percentage shrinkage allowance of 3½ per cent. is required to cover the losses entailed before the goods are passed on to the retailers. Has this increase in shrinkage been brought about, to any extent, through the endeavour to make a softer or weaker-bodied cheese containing a higher percentage of moisture ? Probably this is a feature of the trade that has been overlooked by the advocates of increased water content in our cheese.

—*Dairy Division.*

CONDITION OF HIDES.

LOSSES BY FAULTY BRANDING AND FLAYING, AND HORNING.

THE accompanying photographs will convey to those interested in the raising of cattle the widespread damage done to hides by faulty branding, by horning, and by the inexperienced or careless use of the knife in removing the skin from the beast. Fig. 1 illustrates a case where the point of the knife has so damaged the hide as to have spoilt practically half of it. Fig. 2 shows a brand that has been burnt into the hide—not only in an unnecessarily cruel manner, but also into the best part, which is used for making sole leather and belting—ruining the hide so far as its utility for these purposes is concerned. Figs. 3 and 4 show the serious results to the hide of allowing cattle to carry horns instead of being dehorned.

In 1924 there were produced in New Zealand some 593,000 ox and cow hides, also approximately 870,000 calf-skins. A proportion only of the calf-skins were branded, but in a number of cases the yearlings and vealers were more or less gored. It will thus be seen that many thousands of pounds are lost every year to the producers owing to lack of attention to proper flaying and branding. Corresponding loss is also suffered by our hide-export trade and leather industry.

Great improvements have been introduced of late for the mechanical flaying of hides where considerable numbers of cattle are treated. In correspondence with the New Zealand Tanners' Association, the Imperial Cold Storage and Supply Company of South Africa mention that they have had successfully installed and operated an electrical flaying-machine, with the result that better flaying alone has meant from their own killings 1d. per pound advance in the value of the hides—equal to 4s. to 6s. per hide in mature cattle.

With a view to eliminating as much as possible in New Zealand the losses referred to, the New Zealand Tanners' Association has approached the Department of Agriculture for assistance in securing the passage of legislation with regard to branding and dehorning, to the following effect:—

(1.) The mark shall be permanently applied to the skin. In the case of cattle, the branding shall be not less than 2 in. in height and not more than 6 in. in width, and shall be applied by being burnt into the skin only on the shoulder or neck by a branding-iron, or in such other manner as may be prescribed.

(2.) It shall be compulsory, on and after a date to be decided on, that all calves born, if not registered pedigree cattle, shall be dehorned.

In reference to the first clause, it may be explained that the shoulder and neck are of much less value in the leather than the rump. Figs. 2 and 4 show the most valuable part of the hide. As regards the second clause, it should be mentioned that horn-suppression in young calves and dehorning of older cattle (other than stud beasts) have been strongly advocated by the Department of Agriculture for a number of years past.

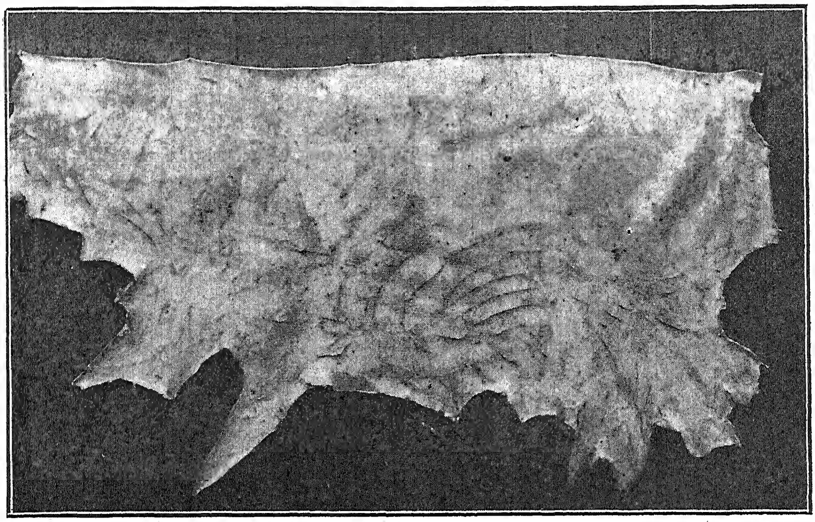


FIG. 1. A BADLY FLAYED HIDE, PRACTICALLY HALF HAVING BEEN SPOILT BY THE POINT OF THE KNIFE.

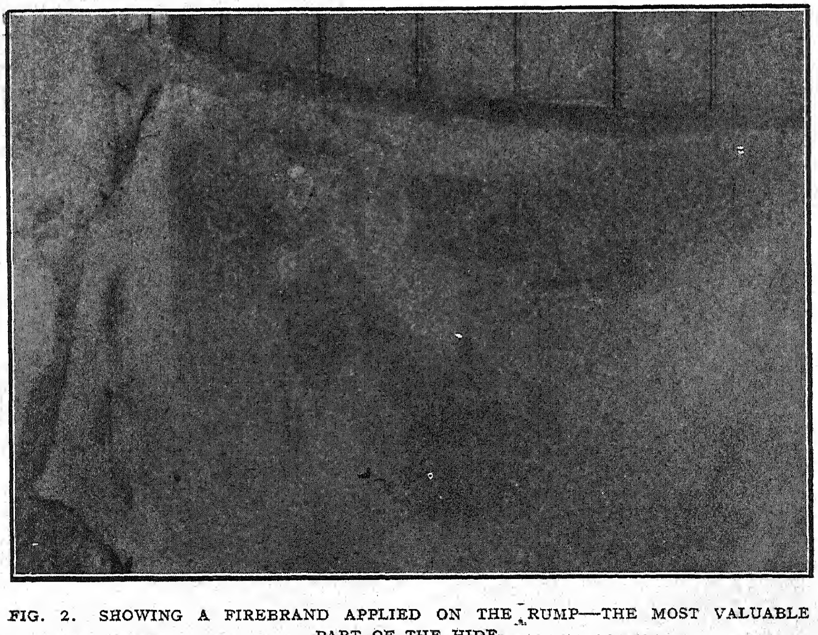


FIG. 2. SHOWING A FIREBRAND APPLIED ON THE RUMP—THE MOST VALUABLE PART OF THE HIDE.

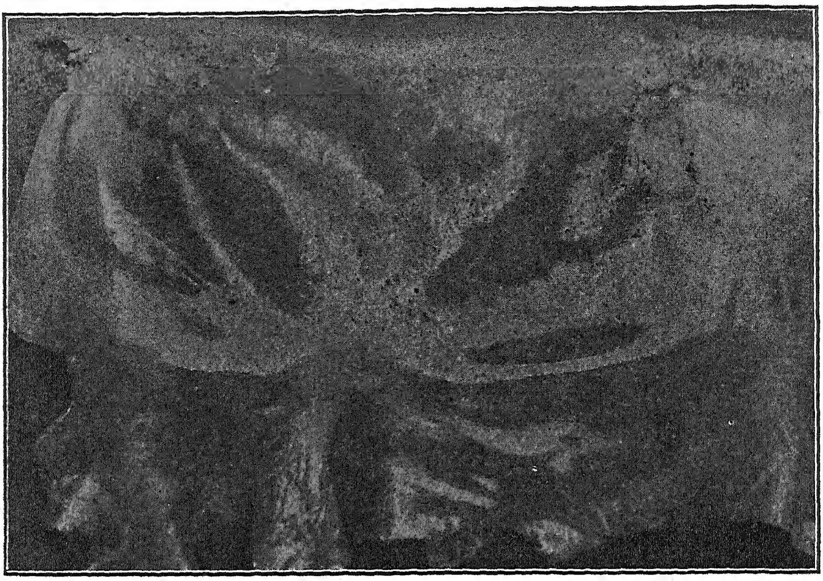


FIG. 3. HIDE QUITE SPOILT BY HORN-MARKS.

FIG. 4. HORN-SCRAPES SPOILING AN OTHERWISE GOOD UNBRANDED HIDE.

SEASONAL NOTES.

THE FARM.

HARVEST.

THE season being late, harvesting operations will not be so general as usual during January. In Canterbury, however, wheat cutting and stooking will form the chief agricultural work. Barley will also be ready, and late oat crops may yet be standing. The time for cutting wheat should be given greater attention. Loss frequently takes place by crops being cut when the nodes on the stems are still green, and in other cases through the crop being allowed to get too ripe, when a good deal of shaking takes place. The former is the lesser evil of the two, for shaken grain is a complete loss, whereas a bushel or two per acre lost through early cutting often gives some compensation in the sample being thin-skinned and consequently attractive to the miller. It is often assumed that Velvet wheat shakes badly, and in a measure it does, but College Hunter's is certainly no better in this respect. It is best to keep stooks on the moderate side as regards size, from eight to ten sheaves being usually ample. The material then dries quickly, and may be either stacked or threshed out of the stook much sooner. This is specially important where the weather is unreliable.

Plains cocksfoot, where grown for seed, will be ready for threshing during the coming month, and should, where possible, be threshed out of stook, as shaking occasions heavy loss. Cocksfoot should be cut on the early side, so to avoid the seed-sample containing too many husks and kernels.

It is generally an indication that a white-clover stand is ready to cut for seed when the stalks begin to lean over at an angle of 45°. It will be found that at this stage the seed is set. Cutting should be done in the opposite direction to the inclination of the clover-stems. On one well-known make of mower there is an adjustment for lengthening the reach of the spring. This allows the knife to fall lower. As the clover is frequently short the knife should be kept as close to the ground as possible.

Crops of seed-peas, either of the long-strawed or medium-strawed varieties, provided the crop is thick enough, may be advantageously harvested with the mower fitted with special steel bands which trail behind and roll the peas to one side. This method is less wasteful than that of the mower and hay-rake. Another system of harvesting is by using the side deliverer. Peas should be well fielded before stacking, but not so long as to allow the pods to split open and shed their seed. Peas are generally right for putting into the stack when only about one-third of the pod appears green, the rest being dry. Pea stacks should be covered or thatched as soon as possible after building, as the straws do not easily turn the rain. Tares may be harvested in practically the same way as peas, the best method being with the mower-bands.

FEEDING OF FORAGE CROPS.

Early-sown crops of millet and rape should be ready for feeding

feeding should start when it is 6 in. to 8 in. high. If this is done it will stool out and give a lot of feeding during the autumn, and stock will do better on it. Rape, on the other hand, should be allowed to ripen before being stocked. When the leaves take on a bluish tinge it is about right, although if urgently required it may be fed earlier.

Lambs confined on rape are inclined to scald, and, where possible, they should have access to some other fodder. If available, millet is very suitable for this purpose. The alternative is a run-off on grass or clover.

If rape or turnip crops are being badly attacked by aphis or moth it is good practice to feed the leaves off quickly with lambs or other suitable stock, and thus starve out the pest. The subsequent growth is then usually fairly clean.

Dairymen careful of their reputation at the factory will see that any turnips they may be feeding to their cows are allowed to wilt at least twenty-four hours. The feeding-out should be conducted in a systematic manner, the roots being scattered lightly in long lines across the field, at intervals sufficient to minimize "hunting" by the dominant cows of the herd, yet close enough to ensure a covering of the field with dung. As soon as the roots are cleaned up, the cows should be turned on to a clean uncontaminated pasture. Much of the taint in milk is undoubtedly due to the fact that cows are often allowed to remain on the same befouled pasture, where they lie down to ruminate, and so contaminate the belly and udder with the turnip refuse. This means evil-smelling cattle and a shed reeking of turnips, with the natural result of the odours being taken up by the warm, freshly-drawn milk. As soon as the field has been well dunged it should be harrowed, shut up, and a fresh growth of grass allowed to come away.

WINTER AND SPRING FORAGE CROPS.

Where the sowing of turnips and swedes has not been completed by the end of the year this work should be pushed along if the weather is favourable. On the higher situations and where the rainfall is good sowing may continue right up to the end of January, but in most places it will be found more profitable to sow turnips than swedes after about the third week of that month, as they come on quicker and the chances of a good crop are greater. Hardy or Imperial Green Globe are suitable turnips for January sowing. If any later, better results will be obtained from White Stubble. The land should be worked to a fine tilth to ensure moisture for a rapid germination. Super or basic super, at 1½ cwt. to 2 cwt. per acre, are suitable fertilizers. If more than these quantities are being used at this season (particularly if the ground is dry) it is best to broadcast half of the material and harrow in, sowing the remainder with the seed. If large quantities of fertilizer are applied with the seed in dry, warm weather there is a danger of it having a detrimental effect on the germination.

In Southland and south Otago crops such as chou moellier, thousand-headed kale, and cabbage are generally sown before the middle of the coming month. A usual seeding is 10 oz. to 16 oz. per acre, in ridges 28 in. wide; manuring, a mixture of 1 cwt. superphosphate and 1 cwt. ground rock phosphate. Chou moellier is of great value as a winter forage, the fact that it grows well

on club-root-infected soil being of importance. It stands frost well, does not taint milk, and has a very robust habit of growth. It is thinned out eventually to about 12 in. apart, with either the hand or horse hoe. The land intended for such forage crops should be well worked, so as to encourage rapid growth.

The end of January is about the best time of the year to sow Western Wolths rye-grass for winter and spring feeding in Canterbury. Summer-fallowed land is particularly suitable, and larger areas of this valuable crop should be sown. In the north-west shower areas, near the hills, January sowing of Western Wolths is strongly recommended, while February sowings will be more suitable for the plains.

A mixture of Italian rye-grass at 30 lb., with crimson clover at 5 lb., and 3 lb. or 4 lb. cow-grass, per acre will provide useful winter grazing. Where the land is required for spring sowing, Algerian oats or Black Skinless barley also make good winter and early spring fodder.

POTATOES.

Main crops of potatoes should receive attention for weed-control by horse-hoeing and moulding up as growth progresses. Spraying should be done during early growth, and repeat dressings given as required. A suitable spray is Burgundy mixture, which is made as follows: Dissolve 4 lb. sulphate of copper in a 40-gallon barrel; when dissolved, add water to make up to 35 gallons. In another vessel dissolve 5 lb. washing-soda in 5 gallons water. When the soda is completely dissolved, add two parts copper sulphate to one part washing-soda, stirring vigorously all the time. The mixture should be bright blue in colour and be used within ten hours of mixing.

LUCERNE.

Where lucerne stands are becoming infested with weeds or grass advantage should be taken to thoroughly cultivate during hot, dry weather immediately after cutting. Many stands have become badly consolidated this season, and as soon as weather conditions are favourable the soil should be thoroughly stirred with the narrow-pointed cultivator, and every effort made to kill foreign growth which has taken hold as a result of consolidation. Owing to unfavourable weather many areas intended to be sown in lucerne have been held over, and these should be kept stirred with the idea of sowing in February.

BUSH-FELLINGS.

Fallen bush ready for the fire during February should be looked over, and where practicable the axe used to lop branches and compact the fall so as to aid a good burn. This will lessen the amount of logging up in the future. Logging should also be carried out preparatory to firing, and tracks cut for stock. The piling of sticks, &c., on second growth ensures the hot fire necessary to kill the surface roots of troublesome plants such as hard fern and water fern.

On all but the richest bush country, and certainly on all secondary burns, the grasses demanding lower fertility conditions should be

of the country, its natural fertility, soil-moisture content, rainfall, and aspect. A shady face requires a different mixture from that sown on a sunny face, and the haphazard practice of sowing hill country, with its ever-changing features of faces, knolls, and gullys, with the one mixture is to be deprecated.

MISCELLANEOUS.

The wireworm pest is in evidence in some localities. Good and frequent cultivation, where possible, is one of the best methods of control. On wireworm-infested land it is advisable to grow temporarily such crops as beans, rape, or peas, as these are not to any degree susceptible to attack.

The sowing of Japanese millet under irrigation is advocated for Central Otago. Sown at the rate of 16 lb. per acre, this crop will come in very useful for feeding off during January or February, and in the event of not being required for that purpose will make an excellent hay.

Land which has been ploughed out of old pasture, and which is intended for autumn sowing, should be periodically grubbed, especially where yarrow, brown-top, or other twitches are present.

Thin, old pastures may be allowed to run to seed-head if convenient, and subsequently thoroughly tripod-harrowed. In many instances this method will assist in making a better sole. In the case of young grass it is very necessary not to allow seeding to take place in the first year. If stock cannot be depended upon to check seeding a mower should be used.

—*Fields Division.*

THE ORCHARD.

SPRAYING OPERATIONS.

From now onward through the coming month, though spray applications may be made at longer intervals as the possibility of further infection of black-spot becomes less, this disease cannot be overlooked. Everything depends on the weather conditions, and though one might like to discontinue fungicides it is not safe to do so. The strengths of lime-sulphur may be decreased where the foliage is clean, or greater reliance may be placed on the less caustic forms of sulphur sprays during drier weather, with the added degree of safety as to burning. Other factors must also be considered when deciding spraying operations for the rest of the season, chief among which is the prevalence or otherwise of red-mite. If a grower is satisfied that danger from fungous diseases is past, and red-mite is in evidence, he may rely on Black Leaf 40 at 1–800 to keep that pest in check, used in combination with arsenate-of-lead powder, 1½ lb. to 2 lb. to 100 gallons; but where all pests and diseases are to be controlled in the most economical way, the lime-sulphur, sulphur paste, and arsenate-of-lead combination is the most reliable, using ½ gallon lime-sulphur, 6 lb. sulphur paste, and 2 lb. arsenate-of-lead powder to 120 gallons.

Stone-fruits should also still receive attention, using lime-sulphur and a sulphur paste, ½ gallon of the former and 6 lb. of the latter, until the fruit is picked; or ¾ gallon lime-sulphur to 120 gallons may be

used in lieu of the combination with little risk to the trees. The pear crop is usually safe from further black-spot infection from now on, and need only receive arsenate-of-lead sprays, $1\frac{1}{2}$ lb. to 2 lb. to 100 gallons.

At this time cherry-leaf or pear slug will be making its appearance. On cherries it is particularly loathsome, and should be dealt with, prior to picking, with hellebore powder, 1–20. This spray soon dissipates, and does not stain the fruit. On pears the disease will be controlled by the arsenate-of-lead sprays. Plums should also be protected when green with arsenate, and, if ripe, with hellebore.

CULTIVATION.

An endeavour should be made to get all necessary cultivation concluded and cover-crops sown by early January, leaving the land in good condition for the gathering of the fruit crop, which will soon be in full swing.

PREPARATIONS FOR HANDLING THE PIP-FRUIT CROP.

Most growers are hoping to dispose of a greater bulk of the fruit to overseas markets this season, and preparations should be advanced to cope with the increased quantities to be handled. Graders should be overhauled in readiness, cases made up, and packing-supplies ordered in advance, stamps overhauled, and cases labelled. In most orchards and sheds old cases are available which can be used for picking. These should be renailed for the purpose, thus saving the new cases for packing only, so that nothing but clean, presentable packages may be shipped.

While they may concentrate on export, growers must not overlook the fact that the local markets demand every consideration for proper grading and packing, and that lower grades and faulty fruit should not be dumped on to local consumers indiscriminately. Fruit should be packed with all due care, and grades properly defined and stamped on the cases, so that buyers may operate with confidence according to the value of the grades contained therein.

THINNING AND BUDDING.

Other operations to receive attention during the coming month include the continuance of thinning of apples, especially Dougherty, Yates, Scarlet Nonpareil, and other small later kinds which may be still too crowded. Budding of stone-fruits may also be proceeded with, according to the development of the young wood in the several localities. By starting early, observation a little later will disclose whether success has been attained, and, if not, further buds can then be inserted.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

A prolific flowering of both oranges and lemons indicates an abundant crop, and every effort should be made at this season to keep the young fruit free from pests and diseases, in order to ensure a high proportion of first quality. Owing to the mixed nature of many orchards the citrus section is often rather neglected at this period in favour of the more pressing work, such as the harvesting of stone-fruit, &c. Attention is directed to this because, while it may not be apparent, this is really a most critical time for the citrus crop.

Cultivation of the soil to a fine tilth is necessary to conserve moisture, whereas lack of cultivation results in a severe check to the tree, temporary suspension of fruit-development, and often a heavy fall of leaves.

Spraying should on no account be missed or unduly deferred at this period. Thrips and mites become established on the trees, causing damage to foliage, with partial defoliation; also disfigurement of the rind of oranges in particular. The young of overlapping broods of scale will also be present, and, unless dealt with, these not only inflict damage to the tree but become more difficult to destroy. Suitable insecticides are oil, 1–60, or nicotine, 1–800, plus soap, 3 lb., per 100 gallons. The lengthy period of lemon-flowering results in fruit developing after the main crop has been sprayed, and continuation of bordeaux, 4–4–40, is therefore necessary to ensure all fruit being coated at the fall of bloom.

At this season extended growths are made by lemon-trees (usually about 2 ft. long, but often more) before a natural division takes place. These growths should be dealt with by pinching to cause the division at a more suitable place. An extension of 12 in. to 16 in. is quite suitable. Attention to this work when the shoots are young results in a more sturdy tree, and obviates the necessity for later hard cutting to bring within bounds the heavy straggly growths natural to the lemon.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

GUARDING AGAINST VERMIN.

THESE enemies of poultry breed and multiply at an alarming rate during hot weather. It is therefore of importance that every precaution be taken at the present time to guard against vermin getting a foothold. It is a good plan to give the whole of the interior of the house a coating of tar. Tar thoroughly applied not only acts as a good disinfectant, but, in addition, covers up every crack and crevice, the common harbouring-places of vermin, especially of that little night marauder the red-mite.

As to vermin that are found on the body of the fowl at all times, the best way of dealing with these is to provide a good dusting-place. I have lately seen a flock badly infested with vermin, but without a soft piece of ground for them to dust in. It would have taken the owner only half an hour to have spaded up a corner in each of the sun-baked runs and provided the dusting-places the birds were craving for, and, as there were shrubs in every run, conditions were ideal for this purpose. It is not generally known that feather-pulling is frequently caused by birds being badly infested with vermin. As with the majority of troubles affecting poultry, the best of all means of dealing with vermin is by prevention. The great essential is to free the quarters as well as the birds from these pests, and provide ample space for exercise.

It will generally be found that male birds, especially old ones, will not make use of dusting-places. As a result they become infested with parasitic life, and gradually get into a weakened state, making them susceptible to every passing ailment. Therefore

male birds should be frequently examined, and if found to be infested they should be given a good dusting with a reliable insecticide, care being taken that the powder reaches the skin.

THE QUESTION OF EARLY MATURITY.

While meat in some form is a most valuable item in the dieting of the growing bird, it should be used with the greatest care, for meat may do as much harm when used at the wrong time as it will do good when employed at the right time. The most harmful effect of overfeeding meat is often seen among the young stock, which, instead of growing into good-sized and vigorous birds, have been forced to maturity before they have attained anything like the standard weight requirements of the particular breed they represent. This does not mean that size alone is everything, but, without going to the extreme often aimed at in the fancy show-pen, we should aim at securing birds which, while true to breed-type, possess weight requirements and laying and constitutional points as laid down in the Dominion utility-poultry standards. There is nothing in these standards in a general way which is antagonistic to the best utility type and the possession of the necessary stamina. While the fancier in many cases makes the mistake of breeding for exceptional development of some fancy point, the utility breeder frequently makes an equally fatal error in aiming at early maturity by improperly developed (undersized) stock. In both cases the best interests of the breeds concerned are being injured. To confirm this one has only to observe the large number of undersized and weedy specimens in many of the utility classes at poultry shows.

A happy mean must be the objective. There is nothing to prevent the development of valuable laying strains of all our popular breeds of poultry without destroying their breed character, size, and stamina. It is to be regretted that not only are many strains of White Leghorns becoming weak in breed-type and undersized, but also birds of the heavy breeds, such as Orpingtons, Rocks, and Wyandottes, are commonly seen not much larger than the desired size of White Leghorn. If such breeds are to be refined down to being merely egg-laying machines like the White Leghorn they will no longer hold their valuable general-purpose character. There is at the present time a keen demand for table poultry, and the consuming public are prepared to pay high prices for choice quality, but they are looking for something better than diminutive specimens. So scarce has choice table poultry suitable for the high-class trade been of late that certain poulterers have intimated to me that unless more and better-quality birds come to hand they will be compelled to resort to importation for supplies.

Reverting to the question of early maturity, it is now generally agreed that early maturity is not necessarily an indication of laying-power, nor premature laying a sign of a desirable breeding specimen. Early laying by the well-developed bird is, of course, not a mistake. The foregoing remarks apply in particular to the pullet which commences to lay when little more than half-grown.

BROODER CHICKS WITH CAKED FEET.

A correspondent asks for information regarding the common troubles of balls of earth, &c., forming on the feet of chickens

during the brooder stage. This is mostly found in brooders where the conditions are not ideal, especially in the matter of temperature, and where cleanliness is not strictly observed. If the correct degree of heat is not provided the chicks are induced to huddle, as a result of which the bedding-material, such as chaff, gets away, and, there being nothing absorptive under them, the droppings adhere to their feet and soon become caked. The best remedy is to remove the cause by supplying the desired warmth, and providing ample dry earth or other good absorptive material on the floor, while on no account should the droppings be allowed to accumulate. To remove the balls, it is a good plan to run the chickens for a short time on wet grass, or give them access to a very shallow tray of water. To attempt to remove the caked material with the fingers not only means suffering to the young birds but injury to their tender feet as well.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

AFTER-SWARMS.

THE beekeeper should give some little attention to the prevention of after-swarms. These swarms are a nuisance, and weaken the parent hive without being of much value in themselves. If the colonies are left undisturbed they will swarm freely, and all chance of a surplus is lost. Among the many plans practised for their control the most successful is that which provides for removing the parent hive. This method is an excellent one, and will usually prevent the issue of the small swarms. As soon as the swarm is hived the parent hive should be removed to a new location in the apiary, and the swarm put on the old stand. The effect of this change is to strengthen the swarm with the field-bees which are absent gathering nectar, and correspondingly to temporarily weaken the old hive, so that it will rarely put out a second swarm. The emerging bees in the parent colony will soon provide sufficient workers to ensure a surplus, and the tendency to swarm will not be so prevalent. In order to make the operation more successful the parent colony should be examined for queen-cells, and they should all be removed save two.

After-swarms should always be returned to the parent colony, unless the beekeeper requires them for increase. In the latter case it is a good plan to dump two or three swarms together, and thus form a strong colony that will gather sufficient stores to carry on through the winter. In dumping, shake the swarms on to an excluder placed between the supers, so as to take out the young queens. Before returning an after-swarm, overhaul the parent hive and cut out all the queen-cells. Place two or three empty combs or frames fitted with sheets of foundation in the brood-chamber, and put the brood over an excluder to hatch out. In case the colony contains a virgin queen, the combs, before being placed over the excluder, should be shaken in front of the hive to make sure that

the virgin queen is not confined above the excluder, or she will not get mated, and a drone-raising colony will be the result. A good plan at all times is to provide an opening for the bees between the super and the brood-chamber, which can be done by inserting a small block of wood immediately under the edge of the super. This will allow the bees to fly freely, and in case the virgin queen is by accident confined to the super an opportunity will be given her to fly and get mated. Likewise the drones can pass out of the super. If on making a later examination the queen is discovered in the super she can be placed in the brood-chamber under the excluder.

FOUL-BROOD.

As advised last month, beekeepers should not fail to treat diseased colonies where found. This work should be carried out in advance of the main flow, so that the beekeeper's undivided attention may be given to securing a crop. Over and over again the treatment of disease is delayed until such time as the season is advanced, and as a result the affected colonies do not count as producers in the main crop; whereas if treatment is carried out as soon as nectar is being freely secreted these colonies will be in good heart to produce a surplus. When the beekeeper is in doubt as to the presence of disease it is advisable to forward a sample of the comb to the Director of the Horticulture Division, Wellington, or to the Apiary Instructor for the district, for examination.

QUEEN-EXCLUDERS.

The season is at hand when it is advantageous to use queen-excluders. During the height of brood-rearing, and in order not to cramp the queen, she should be allowed the full use of the super, so that large numbers of worker bees may be raised to work the main crop. It is not wise to bring the excluders into use too early, and never until such time as the bees are working freely in the super. By cramping the queen fewer bees are produced, and small returns will be netted. Every encouragement must be given to the queen to lay to her utmost, and by so doing populous colonies will be produced.

The best time to put the excluders on the hives is when the main flow sets in and the bees are busy bringing in the nectar. Too many beekeepers make the mistake of putting on the excluders when the supers are first placed on the hives, and it is not an easy matter to get the bees to work in the supers even if combs of honey are raised from the brood-chamber, as excluders tend to make the passage between the lower story and the upper more difficult for the bees. Before placing on the excluders, make a careful examination of the colony to note its condition and to take stock of the number of frames of brood in the hive. If the brood-chamber is full of brood the combs may be manipulated so as to provide the queen with ample room for laying during the period which follows. The best plan is to place the majority of frames of capped brood over the excluder, and to substitute empty combs, taking care to see that the queen is confined below. As the bees hatch out over the excluder they will become accustomed to passing through it, and as fast as the cells become vacant they will be filled with honey. If eggs are

raised with the brood, care must be taken to see that the bees do not raise queen-cells, for in the latter case the hive may swarm out, leaving one or more virgins in the top story, and these queens, being confined to the hive, cannot get out to be mated, and will eventually develop into drone-layers. Within one week after raising the brood, examine the combs in the super to note if any queen-cells have been raised. If any are found they must be destroyed.

The advantage of the use of queen-excluders is in saving labour at the time of extracting, by doing away with the work of picking over the combs. Much time is lost in this operation, and extracting is retarded when everything should be hurried. It is only by the use of excluders that bee-escapes can be employed, and in many seasons, depending largely on the weather, these have to be brought into use.

TREATMENT OF SWARMS: PROVISION OF SUPERS.

There is a little doubt in the minds of many beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame hives and not provided with room for surplus. Unless supers are given to strong early swarms from ten to fifteen days after they are established these colonies will often swarm again and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, and large amounts are yearly lost through the beekeeper neglecting to give ample room for the swarm to store honey. When a swarm has been established a few days a hurried examination should be made to note progress, and from this the beekeeper will be able to form some idea as to the time at which the super will be required. Nothing works so well as a swarm under proper treatment, and the attention given in providing supers will amply repay the beekeeper.

QUEEN-REARING.

In last month's notes attention was directed to queen-rearing. Every effort should be made to requeen the apiary during the working season, so that the colonies will go into winter quarters headed by a good queen. It often happens that the beekeeper is dissatisfied with his stock, in which case his best plan is to send direct to some reliable breeder and secure a number of good queens. Whether this suggestion is carried out or not, when raising queens the beekeeper should select the best stocks in his apiary; in other words, queens should be raised from queens whose bees have a record as honey-producers.

THE HONEY-HOUSE.

Section 18, subsection (5), of the regulations under the Sale of Food and Drugs Act provides that "Every place used for or in connection with the sale, manufacture, preparation, storage, or packing of any food for sale shall be used for that purpose only; and no place shall be so used which is at any time used as a sleeping-apartment, or in which any animal is allowed to be, or which is or has been used for any purpose which would be likely to contaminate such food or injuriously affect its wholesomeness or cleanliness." It is quite clear from this what is required of the beekeeper in dealing with honey as an article

of food. The producer should remember at all times that, as honey is not subjected to heat to destroy foreign matter before being consumed, too much care cannot be observed in its preparation. The extracting-room should be kept scrupulously clean, and the utensils receive the same care and attention as are necessary in a dairy.

A good extracting-house is an important adjunct to every well-equipped apiary, and unless special attention is paid to the building the tedious work of extracting and bottling the honey will cause the beekeeper a good deal of anxiety during the working season. Perhaps no set plan can be given for the size of a honey-house, and it may be left to the individual beekeeper to erect one to suit his needs. However, it is highly important that ample room should be provided for extracting and bottling the honey, also for storing spare supers during the winter months. Too many beekeepers err in not providing enough space, and extracting operations are consequently hampered and the work of handling the crop is increased.

In addition to plenty of space, good ventilation should be provided. See that the windows and doors are well screened to prevent the entrance of bees, which are liable to become a nuisance during operations. A good plan is to hang the windows on pivots so that they will swing from the centres, thus allowing them to be revolved. Where the windows are fixed it is essential that bee-escapes be used, so that as the bees crawl up the window-frames they will pass through the small holes in the escapes. Suitable escapes can be purchased, or cones may be made of fine gauze and these attached to the screens on the windows.

Where bees are kept in small numbers the question of economy may have to be considered, but it is poor policy to work without a certain amount of convenience. The advantages of working in a roomy, cool, well-ventilated, bee-proof house are many, and the question of expense should not deter the beekeeper from providing the best extracting-house possible.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

THE VEGETABLE-GARDEN.

MANY of the earlier-planted crops will now be coming to maturity, and nothing will be gained by allowing them to remain after that point is reached. There is room for a great deal of good judgment in carrying out harvesting operations satisfactorily. The demand for early potatoes is usually sufficient to account for their prompt removal, but other crops, such as the early onions and others, are allowed to remain after maturity has been attained, and not only is the land idle but the crop actually depreciates. Harvest promptly in fine weather, carefully considering the steps taken. Especially is this necessary where crops have to be stored.

An application of hot limewash, and increased ventilation, would make a valuable increase in the storage returns of some buildings. Each product has its own special requirements in storage conditions, and these must be studied. After thoroughly ripening the crop of onions outside, or in an open shed if wet weather compels, they should

be stored in clean, dry, well-ventilated conditions. To leave them for any length of time in sacks is detrimental. Where potatoes have to be selected for seed, see that they are sound, of true type, and from plants of good habit; such selection will soon obtain a strain of value for both quantity and quality of its produce.

Late crops of potatoes and onions will be just in the middle of their growth, and will require careful attention as regards fungous blights should the weather be close and wet. In the case of such blights, the danger period usually commences early in the New Year, when, if conditions threaten, an application of bordeaux, 4–4–40, should be given, carefully covering the under-side as well as the upper surface of the leaves, and repeating the application after an interval of fourteen to twenty-one days, as necessary. The 4 lb. of rock lime can be replaced in the recipe by 6 lb. of washing-soda if it is more convenient. Such a compound is given the name of "Burgundy mixture." A threatened attack of mildew in the onion crop, which trouble is often prevalent at this season, is best treated in a similar manner, reducing, however, the strength of the bordeaux formula to 2–2–40.

Celery, leeks, brussels sprouts, and broccoli that have been planted out and have become established may be given nitrate of soda, 1 oz. to 2 yards of drill, where necessary, remembering it is inadvisable to force these winter crops hard, owing to the rough weather they usually have to contend with. The planting of these crops, also savoy cabbage, should be completed during the coming month, and in the colder sections as soon as possible. Water the seed-beds well in the evening, pull the plants next morning, and stand them in handy trays for planting out. Plant during the afternoon, discarding all cull plants and rogues—that is, any plants not true to type. If there is any sign of green-fly or other infestation, dip the tops of the plants in a suitable spray wash before planting them. Growers in the warmer localities could very well replace the broccoli with cauliflower, which can be grown in half the time. Varieties for cutting during autumn and winter should be planted now.

Dwarf peas and French beans sown now will produce a useful late supply of these popular vegetables.

THE TOMATO CROPS.

The outdoor tomato crop will commence to ripen now, and arrangements for picking, packing, and marketing will need to be made. While the refinements of packing for the markets of this country can easily be carried too far, the general tendency at present is towards the opposite extreme, and is the cause of much dissatisfaction and loss to the grower. Tomatoes that are mature, coloured, or ripe should be kept in their respective classes, and green, immature, and soft-ripe fruit must be excluded. This demands careful pickers, properly instructed and supervised. Followed up by a reasonably consistent pack, a sound and increasing business will be assured without an unprofitable correspondence regarding complaints and rebates.

The harvesting of tomatoes grown under glass will be more than half completed, and the tendency in the rush of other business is to neglect these plants. This would not be so bad if ample

ventilation were given, which might well be done at this season by leaving the ventilators open night and day. This would be better than leaving the house closed and a prey to mildew, as is sometimes the case.

SMALL-FRUITS.

In order to obtain good results from areas devoted to berry fruits, seasonable attention must continue to be given. Now the raspberry harvest is completed, the old canes and weak misplaced growth should be cut out level with the ground *and carried off and burnt*. Thoroughly spray the remaining canes, as may be necessary, for fungus and insect pests. Strawberry-plots that have run out and completed their career should be ploughed, and the land prepared for other crops. Beds that are to be carried on for another year will need to be cleaned up, and, where necessary, an application of manures made so that the plants may make the most of autumn growth and finish the season in good heart.

Currants, gooseberries, passion-vines, and Cape gooseberries, besides cultivation, require careful inspection at frequent intervals at this season, so that at the first sign of disease suitable remedies may be applied.

TOBACCO.

The work for the month in the tobacco-fields will consist chiefly of topping (the pinching-out of the terminal bud on the main stem as soon as there are indications that the plant has attained its full height) and suckering (the breaking-out or pinching-out of laterals that push out from the axils of the leaves on the main stem), both with a view to throwing the nourishment into the leaves and completing their development. The preparation of curing-sheds should now be completed. It is unfortunate when—as has sometimes happened—good leaf is spoiled by unsatisfactory accommodation for curing.

PREPARATIONS FOR PLANTING.

The autumn season is the most suitable in most districts of this country for the preparation of land and planting of herbaceous plants, to be followed by the planting of evergreen and deciduous trees. Intentions of this kind should now be carefully considered, remembering that the majority of the failures in these crops is due to unsuitable trees being planted in badly prepared ground.

—*W. C. Hyde, Horticulturist.*

Blackberry Investigation.—The investigation into methods of blackberry control or eradication was continued by officers of the Biological Laboratory during the past year. A section of several acres densely covered with blackberry was secured in Wairoa County, where a field experimental area has been established. Researches into the biological, chemical, and ecological methods of control in the field are entailing a large amount of laboratory work, and several thousand tests have been made, mainly of substances for, and methods of, eradication. In addition, experiments with control measures by the use of parasites, both insect and fungous, were initiated, and in this connection mycologists and entomologists have been communicated with in all parts of the world in the hope of securing some useful parasite. Further work is being carried out in several places with top-dressing experiments and the use of goats.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

"PEA" IN THE TEAT.

J. S. WARD, Raetihi:—

I have a heifer that has "peas" in her two front teats. She is worth doing something for, but at present it is a miserable job milking her, as the milk comes in such a small stream. I shall be glad if you can let me know of anything that can be done.

The Live-stock Division:—

"Pea" in the teat is frequently a difficult trouble to deal with. We would advise injecting a little warm water through a teat-siphon and rubbing the teat between the fingers so as to endeavour to break down the pea. The siphon should be thoroughly cleaned and boiled before use. If this method does not prove satisfactory, operation is the only thing, and as this involves a risk of damaging the udder further we would not advise it unless a skilled man is available.

SUBTERRANEAN CLOVER.

"SUB CLOVER," Uruti:—

I would be glad of some information regarding subterranean clover. Is it a good grass to sow on rich, heavy papa river-flats where rushes have been dug; and, if so, would it be advisable to sow it alone or with a mixture? Hard fern is a great pest in this country, and it seems to me that, as its seeding system is somewhat the same as that of subterranean clover, the latter should be most useful in combating a return of the hard fern when it has been burnt. I should like to put in a small patch of subterranean clover with the idea of saving the seed. When and how should the sowing be done?

The Fields Division:—

Subterranean clover is an annual plant with a prostrate habit of growth, the stems spreading over the ground to form a dense mass. The flowers are usually white or a very pale pink, and are carried in clusters of two or three upon short stalks. These stalks increase in length after flowering, and, turning downwards, tend to bury the seed in the ground. The plant is strictly an annual, but owing to its habit of burying its seed it readily reseeds itself, and from a farming point of view behaves more like a permanent plant than an annual. Though it appears to possess a considerable amount of adaptability, subterranean clover prefers a mild climate with a good rainfall, and under such conditions will produce a large amount of late winter and early spring feed. It is quite the earliest of the clovers commonly used, and is relished by all stock. It is, however, not a general favourite in permanent pastures of English grasses, owing to its habit of smothering out the finer grasses in the early part of the season and leaving bare patches after it has flowered and seeded, since it produces very little herbage after midsummer. Hence it is used mainly in conjunction with subtropical grasses, such as paspalum, that attain maximum growth in the summer and autumn. Included in the grass mixture, subterranean clover should do well on your river-flats; it will also establish fairly well when included in the mixture for sowing on bush burns in hill country. About the middle of March is the best time to sow. Regarding its use for combating the hard-fern nuisance, experiments with subterranean clover and other plants are being carried out, but these have not been going a sufficient length of time to enable us to give definite advice as to the results. However, owing to its dense habit of growth, subterranean clover should prove to be a useful factor in helping to suppress the hard fern. For the purpose of growing subterranean clover for a seed crop, the best way is to carefully prepare a piece of good, clean, new ground, and sow about the middle of March at the rate of 1 lb. to 1½ lb. of seed to the acre. The seed-bed should be made firm, and care taken not to bury the seed too deeply. When harvesting, it may be necessary to use a rake to drag the seed ...

SILVER-BLIGHT.

A. L. ALLAN, Havelock North :—

Kindly inform me if any method or treatment has been discovered to deal with silver-blight in peach-trees.

The Horticulture Division :—

As far as practical work in the orchard is concerned, it is imperative to carefully sterilize all large wounds, whether made in pruning or by accident, and repeat the dressing annually until they are calloused over. Also all dead branches or trees should not be left lying about, but be burnt before they become a source of infection. A copy of the Department's bulletin on silver-blight has been sent you. In it you will note that the old controversy on this disease is at last settled.

DEFICIENT SHEEP COUNTRY.

"ROMNEY," Waipukurau :—

I have a fairly large block of country that sheep never seem to thrive on. It is second-class land—a rather thin soil on a shale subsoil. It has all been in manuka at one time, but is now mostly carrying a thin sole of danthonia. Owing to the deep gullies it is difficult to plough or top-dress. Could you suggest any lick that would help the stock to develop more bone and to thrive better.

The Live-stock Division :—

Any lick containing phosphorus salts would be of benefit to the sheep, and even a few patches of land top-dressed with phosphates would help the sheep considerably. The following forms a good lick: Salt, 62½ per cent.; precipitated phosphate and bone-ash, 35 per cent.; ferrous sulphate, 2½ per cent.

A NORTH AUCKLAND BUSH-BURN GRASS MIXTURE.

D. S. M., Onetea, Dargaville :—

I had bush felled this last winter, and am desirous of getting a good sole of grass through it. I would be pleased if you could give me a good mixture, and the amount to sow per acre. The bush was medium—mostly taraire, with a heavy undergrowth of nikau and fern in places. The ground slopes towards the west, and the formation is clay, hard in places, on sandstone underneath.

The Fields Division :—

The following mixture of seed per acre is advised: Cocksfoot, 8 lb.; crested dogstail, 3 lb.; Italian rye-grass, 2 lb.; perennial rye-grass, 8 lb.; timothy, 2 lb.; red clover, 3 lb.; white clover, 1 lb.; Lotus major, 1 lb.; paspalum, 4 lb.; browntop, ½ lb.; Danthonia pilosa, 3 lb.: total 35½ lb. Burning would be best done late in February or early in March, sowing as soon after as possible. It must be remembered that careful stocking and spelling of the pasture is quite as important in obtaining a good sole of grass and keeping down secondary growth as is the seed mixture itself.

LICE ON CALVES.

A. M. B., Eketahuna :—

I have some calves troubled with lice. Would you kindly inform me as to the best treatment ?

The Live-stock Division :—

We would advise the following preparation to remove the lice: Soft-soap, 1 lb.; kerosene, 1 quart; kerol, 2 oz.; boiling water, up to 4 gallons. Dissolve thoroughly in the water, then stir in the kerosene. Apply with a spray, or wash well into the hair with a brush. A second application should be made in about

STRENGTHENING A LUCERNE STAND.

W. E. BRITTON, Tauranga :—

Will you kindly advise me how I may increase a stand of lucerne which was sown in November, 1924, in drills 28 in. apart? Can I sow intermediate rows; and, if so, will the cutting, harrowing, &c., of the established growth interfere with the young plants?

The Fields Division :—

From experiments carried out by the Department, in addition to experience of farmers, the attempts to strengthen lucerne stands by sowing seed have not been successful. We would therefore advise you, if you wish to have a stronger stand, to plough up and resow. The previous crop of lucerne usually helps to secure a better stand after resowing.

RABBIT-POISONING BY STRYCHNINED THISTLES.

WALTER FOX, Christchurch :—

I should be obliged if you would give details as to the preparation of the strychnine paste mentioned in the article "Rabbit-poisoning by Strychnined Thistles," published in the October issue of the *Journal.*

The Live-stock Division :—

The preparation and method of use are as follows: To 1 oz. of powdered strychnine-crystals add 2 oz. of icing-sugar. When this is thoroughly mixed, add sufficient water to make a thin paste. After laying the roots of the thistles bare with a small grubber, scrape the roots clean with a knife and apply the mixture with a brush.

PROTECTING GRAPES AGAINST BIRDS.

W. H. CHETHAM, Whangarei :—

Can you give me any information regarding netting grapes for protection from birds? Last season I had a splendid crop, but lost about 25 per cent. of the best, mostly from pheasants. I made a bird-scarer as described some time ago in the *Journal,* and it was very good for small birds, but the pheasants ignored it. I also covered several rows with scrim, tying some every few feet at the bottom, but they even went inside that.

The Horticulture Division :—

The most effective method of protecting the grapes would be to cover them with netting, such as is generally used for covering cherry-trees. Another method would be to place wire netting unrolled along the sides of the rows, the top edges being drawn together and tied between the second and third wires; the wire netting should also be joined together at the end of the rows.

PRECAUTIONS AGAINST CONTAGIOUS ABORTION.

"CAREFUL," Horopito :—

Would a cow having calved at eight months because affected with contagious abortion be dangerous to take into a clean herd—say, next season—if I leave her to go dry this year and separate her from the others? Would leaving her for twelve months without getting in calf at all be likely to effect a natural and perfect cure?

The Live-stock Division :—

We would not advise bringing the affected cow into a clean herd even after letting her dry off. The germ usually remains in the animal permanently or for some years, and she might infect the bull and thus spread the disease among the rest of the herd. Keeping her empty for a year would not necessarily cure her.

LIVE-STOCK IN NEW ZEALAND, 1925.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1924–25.	Number of Lambs tailed, 1924–25.	Sheep (including Lambs) as at 30th April, 1925.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	37,997	50	477,143	180,039	24,318	716,940	324,298	774,793	65,354	789	2,168
Auckland	46,770	4	681,484	300,149	24,092	906,145	425,596	883,760	107,127	1,320	2,049
Gisborne	19,959	53	334,589	26,955	4,737	2,923,097	1,296,651	3,055,726	13,937	257	683
Hawke's Bay.. ..	17,421	24	267,154	48,689	7,985	2,739,214	1,298,306	2,950,796	17,785	1,152	480
Taranaki	21,599	1	376,843	193,414	10,612	799,467	349,824	786,673	55,513	260	1,386
Wellington	43,818	25	701,035	185,597	19,809	5,013,743	2,505,206	5,353,749	70,391	721	493
Nelson	7,883	..	65,240	26,205	3,725	366,012	160,262	425,050	14,392	761	529
Marlborough	7,252	..	46,247	16,272	2,108	948,459	422,616	1,041,406	7,325	217	2,216
Westland	2,525	..	44,881	11,385	2,197	55,799	38,790	63,580	5,030	1	104
Canterbury	61,076	12	201,269	82,263	11,177	3,929,398	2,499,973	4,719,959	50,427	204	112
Otago	34,471	20	137,389	53,220	8,936	2,567,455	1,285,686	3,021,932	20,643	11	28
Southland	26,059	1	170,470	71,379	8,169	1,369,799	859,939	1,470,531	12,191	3	31
Dominion totals ..	326,830	190	3,503,744	1,195,567	127,865	22,335,528	11,467,147	24,547,955	440,115	5,696	13,279
Totals 1924 (or 1923–24)	330,430	148	3,563,497	1,184,977	127,612	21,077,684	11,133,336	23,775,776	414,271	5,579	12,617

WEATHER RECORDS: NOVEMBER, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

During the month of November, owing to the passage of a number of westerly disturbances with lowest pressure in the South, northerly to westerly winds predominated. The southerly changes on the 6th, 16th, 25th, and 26th, though brief, were very marked, and were accompanied by hail and sleet in several places and followed by frosts.

Between the 12th and 18th a disturbance to the eastward of New Zealand intensified considerably, and the lowest pressure reported from the Chatham Islands was 29·07 in. Another disturbance between the 25th and 29th also exhibited lower barometric pressure than occurred in New Zealand, and caused a southerly gale on the east coast, particularly of the South Island.

The districts of the South Island chiefly affected by these westerlies, and the storms that occurred off the east coast, showed rainfalls above the average; while nearly all other parts of the Dominion apparently experienced less rain than usual.

The Auckland report shows that both rainfall and sunshine were below the November means of former years, and the weather was regarded as unseasonable owing to the prevalence of westerly winds.

On the whole, the weather during the month, though somewhat changeable, was warm, dry, and breezy.

—*D. C. Bates, Director.*

RAINFALL FOR NOVEMBER, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
	North Island.			
	Inches.		Inches.	Inches.
Kaitaia	1·94	10	1·08	3·27
Russell	1·90	7	0·80	1·61
Whangarei	1·77	14	0·61	3·41
Auckland	2·44	15	0·60	3·27
Hamilton	3·44	22	1·40	4·05
Kawhia	4·64	20	0·96	4·49
New Plymouth	2·49	21	0·57	4·58
Riversdale, Inglewood	5·12	21	0·84	8·95
Whangamomona	5·20	14	1·11	7·40
Tairua, Thames	1·58	9	0·70	3·55
Tauranga	2·30	11	1·06	3·26
Maraehako Station, Opotiki	1·28	9	0·38	2·78
Gisborne	1·74	8	0·79	3·15
Taupo	2·45	9	0·82	3·41
Napier	0·28	7	0·12	2·08
Maraekakaho Station, Hastings	0·74	7	0·28	2·03
Taihape	2·29	17	0·67	3·67
Masterton	1·42	11	0·38	2·87
Patea	1·93	16	0·34	3·72
Wanganui	0·86	2	0·68	3·31
Foxton	0·72	8	0·20	3·80
Wellington	1·56	15	0·33	3·45
	South Island.			
Westport	5·88	23	1·30	7·08
Greymouth	11·28	25	2·37	9·46
Hokitika	14·32	24	3·42	10·73
Ross, Westland	17·54	19	4·04	13·94
Arthur's Pass	17·78	18	3·59	15·00

RAINFALL FOR NOVEMBER, 1925—*continued*.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Collingwood	4·91	18	1·09	7·68
Nelson	1·25	10	0·59	2·87
Spring Creek, Blenheim	0·57	8	0·30	2·41
Tophouse	4·66	14	1·22	7·07
Hanmer Springs	2·24	9	0·62	2·91
Highfield, Waiau	1·16	6	0·47	2·52
Gore Bay	2·12	10	0·70	1·98
Christchurch	2·42	12	0·50	1·84
Timaru	2·26	10	0·70	1·97
Lambrook Station, Fairlie ..	1·70	8	0·84	2·00
Benmore Station, Omarama ..	1·60	9	0·72	2·05
Oamaru	1·98	10	0·62	1·94
Queenstown	2·23	6	1·34	2·77
Clyde..	0·86	6	0·36	1·36
Dunedin	4·50	20	0·70	3·30
Wendon	3·36	19	0·38	2·54
Invercargill	4·02	24	0·56	4·60

NEW ZEALAND INSTITUTE SCIENCE CONGRESS, 1926.

THE third Science Congress under the auspices of the New Zealand Institute will be held at Dunedin from 28th to 30th January, 1926.

As previously, the work of the Congress will be divided among a number of sections. Section 1 is that of Agriculture, and will be presided over by Mr. A. H. Cockayne (Department of Agriculture, Wellington), with Dr. F. Hilgendorf (Canterbury Agricultural College) as vice-president. The work of this section will include papers and discussions on modern research methods under both field and laboratory conditions, problems of agricultural teaching in schools and colleges and in extension work, as well as original papers giving the results of research. Full use is to be made of the Agriculture Department's court and plots at the New Zealand and South Seas Exhibition. Section 2 is Biology, with Dr. R. J. Tillyard (Cawthron Institute) as president, and Mr. R. M. Laing (Christchurch) vice-president. The other divisions of the Congress are: Section 3, Geology; Section 4, Chemistry, Physics, and Engineering; Section 5, Anthropology; and Section 6, Social Science and Economics.

In addition to the sectional papers and the discussions arising therefrom, it is hoped that joint meetings will be held for the consideration of subjects of wider interest. Thus it is suggested that a joint discussion be held by the Geology, Agriculture, and Biology Sections on the most useful basis for a soil survey of New Zealand.

During the term of the Congress two public evening lectures will be given—one by Professor C. C. Farr on "The Story of the Universe," the other by Dr. P. H. Buck on "The Coming of the Maori."

The president of the Congress is the president of the New Zealand Institute. The general honorary secretary is Dr. J. E. Holloway, Otago University, Dunedin. The honorary secretary of the Agriculture Section is Mr. E. R. Hudson, Training College, Dunedin; and Mr. W. Martin, District High School, Mosgiel, acts similarly for the Biology Section.

Noxious Weeds Orders.—Gorse has been declared to be a noxious weed within the Te Kuiti Borough.

KILLINGS AT MEAT-WORKS, SEASON 1924-25.

ACCORDING to statistics issued by the Meat Producers Board, the total killings at meat-works in New Zealand for the frozen-meat industry year, 1st November, 1924, to 31st October, 1925, were as follows:—

Class.	North Island.	South Island.	Dominion.	Dominion, Season 1923-24.
Lamb (carcases)	2,044,307	2,705,857	4,750,164	4,769,583
Wether mutton (carcases) ..	1,121,866	149,355	1,271,221	1,019,265
Ewe mutton (carcases) ..	669,116	283,926	953,042	920,059
Beef (quarters)	445,834	12,715	458,549	322,829
Pork (carcases)	35,286	467	35,753	4,943
Boneless beef (freight carcases)	204,934	58,804	263,738	266,154
Sundries (freight carcases) ..	43,889	11,072	54,961	81,994

CROP AREAS AND YIELDS: SEASONS 1923-24 AND 1924-25.

Crop.	1923-24.		1924-25.	
	Area.	Yield per Acre.	Area.	Yield per Acre.
	Acres.		Acres.	
Wheat—				
Grain	173,864	24·01 bushels	166,964	32·62 bushels.
Chaff, &c... ..	1,629	1·32 tons ..	1,105	1·59 tons.
Oats—				
Grain	63,842	30·77 bushels	147,387	38·72 bushels.
Chaff, &c... ..	326,652	1·12 tons ..	308,527	1·64 tons.
Barley—				
Grain	21,286	28·07 bushels	25,138	31·75 bushels.
Chaff, &c... ..	590	1·61 tons ..	242	1·64 tons.
Maize—				
Grain	8,208	49·40 bushels	8,621	49·47 bushels.
Ensilage	958	6·12 tons ..	600	4·02 tons.
Peas and beans ..	18,676	19·43 bushels	14,027	29·27 bushels.
Linseed—Seed ..	12,119	0·22 tons ..	6,679	0·32 tons.
Rye-grass—Seed ..	43,487	332·58 lb. ..	66,764	452·34 lb.
Cocksfoot—Seed ..	11,619	122·85 lb. ..	12,258	150·39 lb.
Chewings fescue—Seed	9,279	161·57 lb. ..	4,459	268·69 lb.
Crested dogstail—Seed	4,749	156·53 lb. ..	1,969	198·42 lb.
Red clover and cow-grass—Seed	5,543	143·41 lb. ..	10,400	159·92 lb.
White clover—Seed ..	4,161	132·77 lb. ..	3,196	151·73 lb.
Other grasses and clovers—Seed	2,225	146·84 lb. ..	4,113	272·12 lb.
Grasses and clovers cut for hay	188,979	1·67 tons ..	229,644	1·83 tons.
Potatoes	20,993	5·00 tons ..	23,092	5·27 tons.
Green fodders ..	239,652	..	240,061	..
Turnips	477,381	..	452,894	..
Mangolds	9,989	..	15,111	..
Onions	374	8·76 tons..	548	9·90 tons.
Hops	701	1,374·34 lb. ..	744	1,542·57 lb.

CERTIFICATES ON SEED-EXPORTS TO CANADA.

THE New Zealand Official Seed-testing Station has been authorized by the Canadian Department of Agriculture to issue certificates to the effect that parcels of seed to be imported into Canada comply with the minimum requirements of the Canadian Seeds Act, 1923.

New Zealand exporters are advised to take full advantage of these new provisions which entirely remove any possibility of the refusal of entry at a Canadian port. Samples should be forwarded direct to the New Zealand station with the specified request that the seed be tested and certified to conform with the Canadian Seeds Act. Representative samples of 1½ oz. to 2 oz. of clovers and 2 oz. to 4 oz. of grass-seeds will be necessary for the analyses. Grading under the Canadian regulations cannot be undertaken here, as this may be done only by a Canadian Seed Inspector. Exporters may receive advice as to the possible grading of their shipments, but no certificate to that effect may be issued.

Check tests of all shipments allowed entry into Canada under a foreign certificate will be made in Canada. If the actual shipment should be inferior to the certificate a sample of the seed will be forwarded to the station issuing the certificate for comparison and check test. Any exporters found to be acting in bad faith would thereafter be denied the privilege of having seeds released from bond without previous examination.

It is hoped that in due course other countries will take similar steps towards facilitating international seed trading.

"LAND LEGISLATION AND SETTLEMENT IN NEW ZEALAND."

A BOOK with this title has recently been issued from the Government Printing Office by the Lands and Survey Department, the author being Mr. W. R. Jourdain, late Chief Clerk of the Department. The main object of the publication—a closely printed royal-octavo cloth-bound volume of some 250 pages—is to afford a summary of the legislation passed dealing with the administration of Crown lands since the foundation of the colony. Laws relating to Native and freehold lands are not included.

The work is divided into the following parts: (1) History of Land-settlement in New Zealand; (2) Legislation of the Imperial Government, Governors' Ordinances, and the General Assembly of New Zealand; (3) Provincial Land Legislation, 1853–76; (4) Legislation by the General Assembly, 1877–1911; (5) Legislation by the Government of Right Hon. W. F. Massey, 1912–24; (6) History of the Lands and Survey Department, 1841–1924. An "Official List" of Ministers of Lands, Under-Secretaries, Surveyors-General, and other higher officers of the Department is appended. A dozen illustrations contained in the book consist of portraits of some members of this personnel.

The publication—into which Mr. Jourdain must have put an immense amount of faithful labour—forms a valuable record and work of reference, which will doubtless ensure for it a wide demand. Nor does the book consist merely of dry summarized enactments, &c.: much of general interest is embodied in connection with the early history of the colony, pioneer surveying and exploration, the various land-tenures, and other phases.

The regular published price of the book is 20s., but it is announced that for the first three months remittances of 15s. 6d. addressed to the Under-Secretary, Lands and Survey Department, Wellington, will be accepted in payment.

RUAKURA FARM TRAINING COLLEGE.

THE first term of 1926 at the Ruakura Farm Training College will commence on 29th January. Students wishing to enrol should make early application to the Director-General, Department of Agriculture, Wellington. An illustrated prospectus giving full particulars of the course may be obtained by applying to the Director-General.

ESTIMATES OF THE SEASON'S LAMBING.

Following are complete estimates of the current season's lambing, computed from estimated average percentages furnished by the Inspectors of Stock in the various districts. Corresponding figures for the four previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1925 ..	7,463,735	85·64	6,391,812	..
1924 ..	7,148,949	85·00	6,049,654	6,199,881
1923 ..	7,170,154	91·34	6,549,143	6,170,673
1922 ..	6,771,482	90·36	6,118,530	5,955,081
1921 ..	6,312,456	89·65	5,659,355	5,457,643
		SOUTH ISLAND.		
1925 ..	6,251,488	78·61	4,914,046	..
1924 ..	5,927,145	87·87	5,208,378	5,267,266
1923 ..	5,892,849	83·99	4,949,313	4,962,663
1922 ..	5,724,572	82·53	4,724,475	4,949,440
1921 ..	5,835,332	83·28	4,895,425	4,810,258
		DOMINION.		
1925 ..	13,715,223	82·43	11,305,858	..
1924 ..	13,076,094	86 14	11,258,032	11,467,147
1923 ..	13,063,003	88·02	11,498,456	11,133,336
1922 ..	12,496,054	86·77	10,843,005	10,904,521
1921 ..	12,147,788	86·59	10,518,780	10,267,901

—*Live-stock Division*

FORTHCOMING AGRICULTURAL SHOWS.

Waipukurau A. and P. Association: Waipukurau, 22nd January, 1926.
Horowhenua A. and P. Association: Levin, 26th and 27th January.
Rodney Agricultural Society: Warkworth, 6th February.
Te Awamutu A., P., and H. Association: Te Awamutu, 10th February.
Te Puke A. and P. Association: Te Puke, 10th February.
Dannevirke A. and P. Association: Dannevirke, 10th and 11th February.
Pahiatua A. and P. Association: Pahiatua, 13th February.
Masterton A. and P. Association: Solway, 16th and 17th February.
Whakatane A. and P. Association: Whakatane, 17th February.
Taumarunui A. and P. Association: Taumarunui, 17th February.
King-country Central A. and P. Association: Te Kuiti, 18th February.
Northern Wairoa A. and P. Association: Mititai, 20th February.
Tauranga A. and P. Association: Tauranga, 24th February.
North Kaipara Agricultural Association: Paparoa, 25th February.
Franklin A. and P. Association: Pukekohe, 26th and 27th February.
Omaha and Pakiri A. and H. Association: Leigh, 27th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 3rd and 4th March.
Opotiki A. and P. Association: Opotiki, 9th March.
Morrinsville A. and P. Society: Morrinsville, 10th March.
Hawke's Bay A. and P. Society: Autumn Show, Tomoana, 16th and 17th March.
Mayfield A. and P. Association: Mayfield, 20th March.
Temuka and Geraldine A. and P. Association: Winchester, 25th March.
Methven A. and P. Association: Methven, 27th March.

Agricultural and Pastoral Association Secretaries are invited to supply dates and location of their shows for publication in the "Journal."